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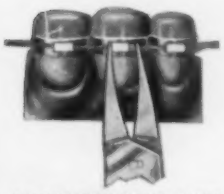

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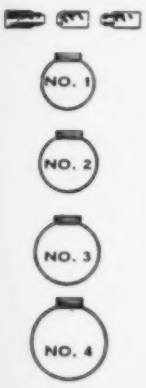

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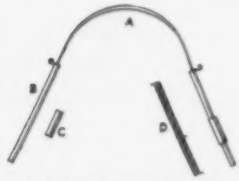

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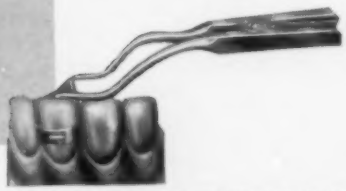

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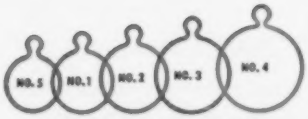

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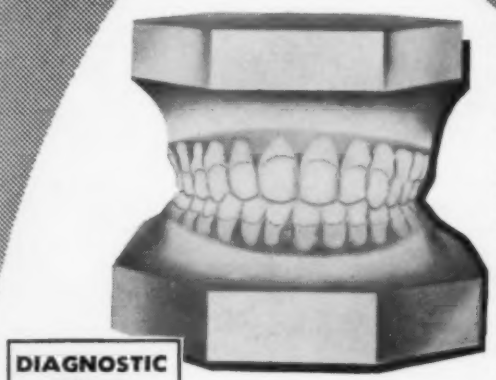

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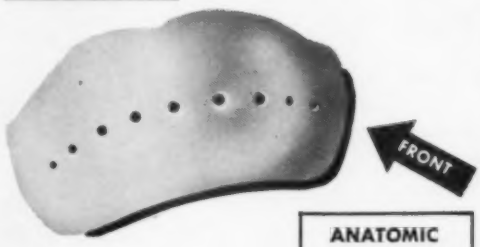

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VOL. 41 JULY, 1955 No. 7

Original Articles

PRESIDENT'S ADDRESS, NORTHEASTERN SOCIETY OF ORTHODONTISTS

PHILIP E. ADAMS, D.M.D., BOSTON, MASS.

THIRTY years ago, Henry Clay Ferris, the fourth president of this Society (then the New York Society of Orthodontists) inaugurated the custom of the outgoing president's presenting a formal report.

This vehicle has been variously used by those who followed to review their administrations; to comment upon the problems of this Society and of the American Association of Orthodontists; to make recommendations for the improvement of this Society, of the parent body, the American Association of Orthodontists, and of orthodontics generally.

A review of these presidential addresses indicates the very important part played by the Northeastern Society in the development of the American Association of Orthodontists and it is my hope that, with the creation of the office of historian, this material will be abstracted and collated in such form that all members of our Society can have the opportunity to read a story in which I am sure they will take much pride.

Immediate Past President Salzmann last year made several recommendations for the improvement of our Society.

The first three recommendations were referred to a special committee headed by Dr. Strang, which reported at the Buffalo meeting. Briefly, their recommendations were: (1) In regard to establishing a better method for determining professional competence of future members, that an examining

Presented before the annual meeting of the Northeastern Society of Orthodontists, New York City, March 8, 1955.

board be set up at the constituent level. (2) In regard to assisting groups who are seriously interested in orthodontics but do not limit their practices to it, that members of the Northeastern Society requested to appear as essayists before such groups should present basic scientific material relating to orthodontics and refrain from discussing technical procedures relating to specific appliance therapy. (3) The recommendation to set up an educational health exhibit relating to orthodontics, to be used at meetings of health and educational bodies, was first to be referred to the Public Relations Committee of the American Association of Orthodontists; this action was later rescinded, and it was voted to appoint a committee to bring in a plan of development for this exhibit.

The recommendation relating to programs, that is, mimeographed statistical tables to be distributed to the members rather than attempting to get such data from slides, was referred to the Executive Committee and will be put in operation at this meeting.

Last year the Board of Censors recommended that the Northeastern Society sponsor and finance an award of $300.00, to be made annually by the American Board of Orthodontics to the author of the most outstanding thesis presented during the current year. A special committee was appointed, headed by Dr. Waugh, to confer with the American Board of Orthodontics. The report of the special committee indicated that the American Board had expressed great appreciation but was unable to accept the gracious gesture on the basis of conflict with other basic purposes for which the Board was created.

At the Buffalo meeting it was voted that the Society present a scroll to each living past president and one to the immediate family of each deceased past president. This will be done at the luncheon tomorrow under the direction of the President's Advisory Committee, of which Past President Richard Lowy is Chairman.

There is pending in the American Association of Orthodontists an amendment to the by-laws, that membership in a constituent society will require "Three years of specialization, including successful completion of an orthodontic course of a minimum of fifteen hundred (1500) hours in a recognized dental school with recommendation of two active members." This will be acted upon at the San Francisco meeting in May. There are members of the American Association of Orthodontists who, while in sympathy with the efforts to raise the standards of eligibility for membership, are of the opinion that some channel should be left open to those who may be competent but do not possess formal graduate training. Recognizing this fact, we have already instructed our director to offer an amendment to this pending amendment, creating boards at the constituent level to examine applicants who do not possess the qualification of formal graduate training.

I have been advised by the Board of Censors, who, as you know, function as a nominating committee, that in their opinion the nominating committee should be increased by two to four members.

In view of this recommendation, plus that of Dr. Strang's committee regarding examining boards at the constituent level and the strong probability that the pending amendment in the by-laws of the American Association of Orthodontists will be amended as outlined, I recommend that the By-laws Committee be instructed to prepare the necessary amendments to increase the Board of Censors in number to seven members and that the Board of Censors be instructed to prepare criteria and methods for a proper evaluation of the professional competence of prospective members who do not possess formal graduate training, these criteria and methods to be presented to this Society for approval.

I wish to thank all committees for their splendid cooperation during the past year. To Dr. Henry Beebe, chairman of the Executive Committee, my very special thanks, as the success of the scientific program has been due entirely to his enthusiastic work in behalf of the Society. Special thanks are also due our secretary, Dr. Wilbur Prezano, and our executive secretary, Mrs. Augusta Grimm.

It has been a great honor and privilege to serve as your president, and my best wishes to the incoming administration for continued success.

EXTRAORAL FORCE—FACTS AND FALLACIES

T. M. Graber, D.D.S., M.S.D., Ph.D.,* Chicago, Ill.

ORTHODONTIC philosophies and therapy, like philosophies and therapies in all other fields, swing with the pendulum. In medicine a couple of years ago, antihistamines were used for everything from nasopharyngitis to allergic swelling of the pedal extremities. Penicillin and the antibiotics have run the gamut of usage for every known disease. Today even the commercial houses and *Reader's Digest* ignore antihistamines, and the common cold is still with us. A new panacea must yet be found. In dentistry, dentifrices are ammoniated, antienzymed, fluoridated, urea-dated, or antedated. In orthodontics, it has been nonextraction, extraction, first premolars, second premolars, second molars, labial appliances, lingual appliances, fixed appliances, removable appliances, square tubes, round tubes, half-round tubes, rectangular tubes, fixed brackets, rotating brackets, lever arms, eyelets, gold, platinum, steel, and extra-oral appliances. At the zenith of popularity now are extra-oral appliances of every conceivable design, with mechanical ingenuity ad infinitum—and *ad absurdum*. The latest? Most certainly! Quoting from the literature: "The value of the occipital bandage is, I believe, becoming more and more appreciated, and is especially applicable in this class of cases [meaning maxillary protrusions]. I am using the appliance . . . in my 16th case, and I consider it much more satisfactory than any of the few devices described in our literature on the subject." This was Angle,[1] in 1887.

Objectively, just what is the role of the extra-oral appliance? Where does it find use? What are its limitations? How valid are the multiplicity of claims made for it? The basis for our remarks today is a study of 100 Class II, Division 1 malocclusion cases treated with extra-oral force, which will be reported before the next meeting of the American Association of Orthodontists in San Francisco, plus clinical experience with its use in miscellaneous phases of mechanotherapy. In advance, I will readily admit that there are clinicians who may not like the appliance we used and who may prefer what they consider more efficient extra-oral appliances. But this is the way I did it; these are my observations, and you can judge accordingly.

In a study of 150 Class II, Division 1 malocclusions, headplates and plaster casts were analyzed. In 107 of these cases the mandibular dentures were essentially normal, with respect to arch form, contact relationship, tooth size and position, and basal bone relationship. These dentures were in a state of

Read before the Northeastern Society of Orthodontists, Buffalo, New York, Oct. 25, 1954.
*Associate Professor, Department of Orthodontics, Northwestern University.

balance that normally would be considered a successful treatment result for many of our cases (Fig. 1). Only when the mandibular casts were related to the maxillary casts was the marked anteroposterior malrelationship noted (Fig. 2). Two-thirds of the cases we see are in this category. Does it not seem logical that therapy directed against the maxillary arch, to make it conform

Fig. 1.

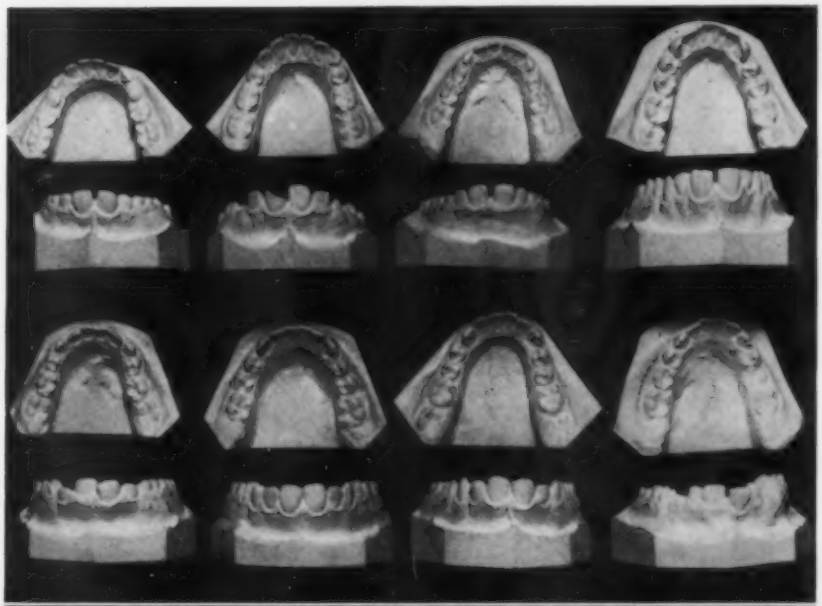

Fig. 2.

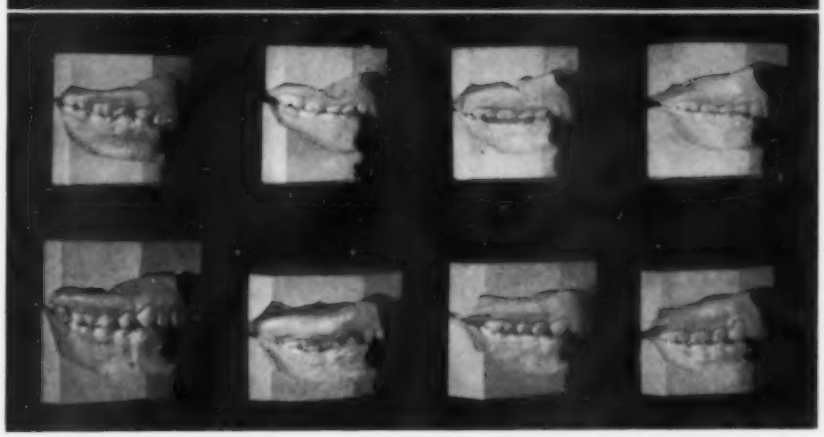

Fig. 1.—Cases taken from the study of 150 Class II, Division 1 malocclusions, as examples of the 107 cases which showed essentially normal lower dentures.

Fig. 2.—Same cases as shown in Fig. 1, with maxillary and mandibular casts articulated.

to the mandibular arch, might be one approach to the problem? If you couple this with the clinical impression that prolonged Class II therapy against the mandibular arch either tips the lower teeth forward of slides them forward on the base, regardless of the type of appliance, then a good argument can be made for directing forces against the maxilla alone, leaving the mandibular

denture undisturbed mesiodistally. Can we, by means of appliances operating against the maxillary teeth, establish normal tooth interdigitation, eliminate excessive overbite and overjet, restore normal muscle function and normal appearance?

In the numerous contributions to the literature on extraoral force during the past ten years, many claims have been made: extraoral force withholds maxillary growth; extraoral force withholds alveolar growth only; teeth are moved bodily; teeth are tipped only; appliance therapy frees occlusal interferences, allowing the mandible to come forward or grow forward; extraoral

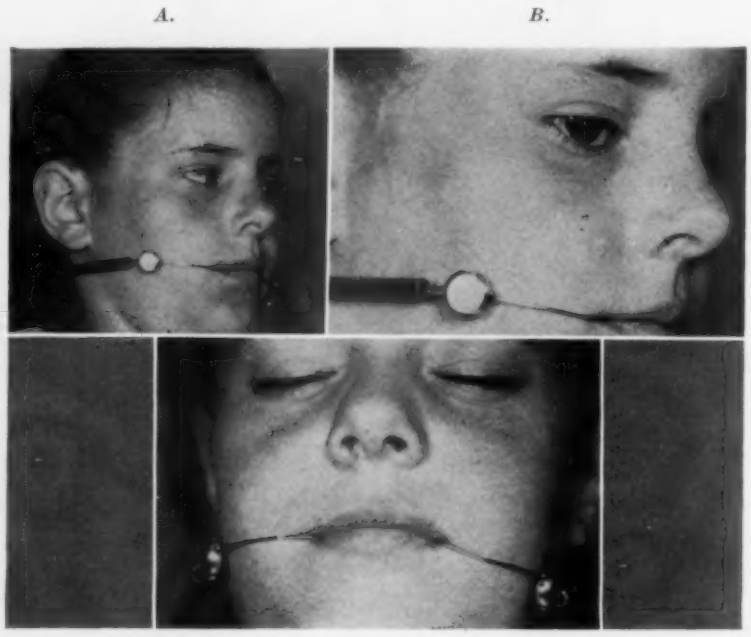

Fig. 3.—Type of extraoral appliance used in study.

appliances are physiologic; they are unphysiologic; extraoral appliances impact maxillary second molars and third molars; they tip maxillary incisors excessively lingual, forcing apices of incisors labially; use of a headgear is more physiologic, with a better direction of pull; use of a cervical band is simpler, easier to wear, and does the same as a headgear; and so on. Some order must be made from this welter of conflicting claims. Objectively, just what does happen in a controlled group of cases? Let us not report only those cases that have worked out, shoving the rest onto the back shelf of the closet. What are some of the untoward results, regardless of the cause? What are the indications and the contraindications? What is the role of growth and development? What questions remain unanswered?

In the 100 cases previously mentioned, a concerted effort was made to appraise the results as objectively as possible through constant patient supervision and the media of routine diagnostic criteria—dental radiographs, plaster

casts, and cephalometric radiographs. In order that variables could be reduced to a minimum, only one type of appliance was used. In the beginning, this was to be the only mechanotherapy, but this plan was altered to include the use of bite plates in some cases. Others later had lower appliances placed, and part-time elastic traction was employed. The appliance (Figs. 3 and 4) consisted of molar bands, an .045 stainless steel labial arch wire with vertical spring loops at the molars, and continuous loops at the lateral canine embrasure to receive the cervical gear. This was a metal tube with a continuous spring inside to provide distal motivating force. In a few cases incisors were banded at one stage of therapy.

The patients were divided into three age groups: deciduous dentition, 3 to 6 years; mixed dentition, 7 to 10 years; permanent dentition, 11 to 19 years. A study of the results of each group will answer a number of the questions already posed. To supplement these cases are observations, made in routine practice, on many cases where extraoral anchorage was employed at one stage of full edgewise therapy to bolster anchorage, to close spaces created by tooth sacrifice by distal movement of the anterior segment, to upright individual teeth, to serve as an active retainer, etc.

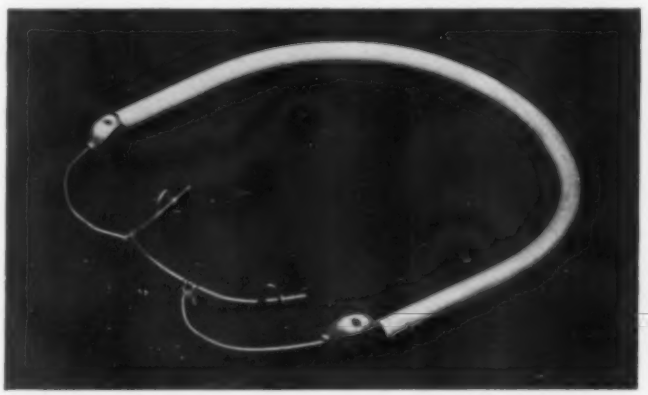

Fig. 4.—Cervical tube, attached to .045 stainless steel arch wire. Tension is conferred by continuous spring inside the tube.

Before answering the questions, an immediate qualification must be made. Class II, Division 1 cases differ greatly. Even if we accept as bases for determining the severity of the problem only the three most important characteristics of this type of malocclusion (maxillomandibular basal relationship, excessive overjet, and overbite), variation is infinite. Success or failure of therapy of any kind depends on the degree of departure from the normal for each factor and on the combination of factors. Logically, in the cases where severe discrepancies exist in all three categories, the prognosis of correction would appear poorest. Now, superimpose on this the patient's morphogenetic pattern, his motivation and cooperation, and the unpredictable increments of growth during appliance therapy, and the prognosis becomes indeterminate.

Dealing with physiologic phenomena as we are, we must not expect a simple answer to many questions or, indeed, any answer at all to some of them. There is no shotgun prescription for all Class II, Division 1 malocclusions and no magic calculating machine that can come up with a pat formula from the maze of information fed into it, and there is no automatic appliance. This is not hedging on our observations; rather, it is an attempt to avoid the pitfalls of oversimplification and the inherent desire to reduce the problem to its common denominator. Now to the questions:

1. *Can we, by extraoral force against the maxilla alone, establish normal tooth interdigitation, eliminate excessive overbite and overjet, and restore normal muscle function and normal appearance in Class II Division 1 malocclusions?* This is a tall order indeed, if you mean *all* cases, regardless of hereditary pattern, age, sex, presence or absence of third molars, growth and developmental increments, and patient cooperation. But let us examine the results of our study and see what information we can get.

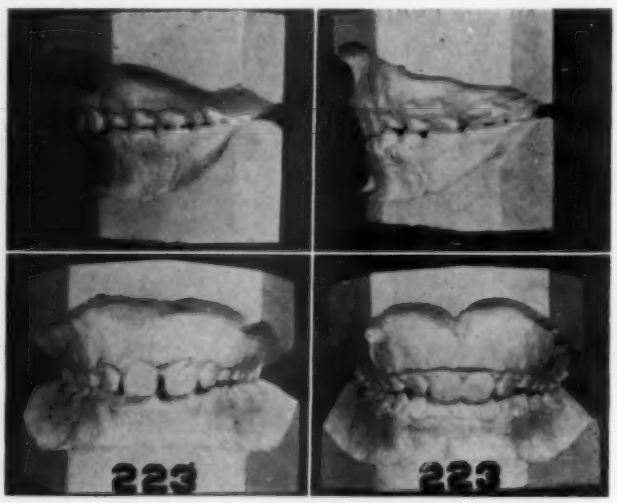

Fig. 5.—Correction of overjet and Class II buccal segment relationship here meant excessively lingually inclined maxillary incisors and residual overbite.

In the fourteen deciduous cases, only three made the grade—but all fourteen were picked for their severity, with marked basal dysplasias. Three cases almost made it, but in well over one-half the cases a Class II relationship of lesser degree remained. On the credit side of the ledger, eleven out of fourteen showed anteroposterior basal adjustment, and most patients showed improvement in muscle tone and function, with a diminution of abnormal muscle habits. General response was slow, despite excellent cooperation on the part of the patients, with the exception of two cases where growth was precipitate and the results dramatic. Correction of overjet meant excessive lingual tipping of maxillary incisors in a number of cases, especially where there were no spaces to start with. The anterior mucolabial concavity decreased quite considerably in most cases. Overbite correction was least satisfactory.

In the thirty-four girls and sixteen boys of the mixed dentition group, a better response was observed. In twenty-nine cases normal molar relationship was established, although this did not necessarily mean normal canine relationship. Overjet correction again meant excessively lingually inclined incisors in some cases (Fig. 5). Vertical correction showed more response than in the deciduous dentition group. In the cases where the departure from the

Fig. 6.

Fig. 7.

Fig. 6.—Excellent response could be expected here because of anterior spacing and good growth increments.

Fig. 7.—Despite severe basal malrelationship, there is only a six-month interval between this headplate and that shown in Fig. 6.

normal in all three criteria—basal relationship, overbite, and overjet—was greatest, the results were generally the least satisfactory. If growth increments were significant, correction was obtained sooner, but this proved an unpredictable factor, favorably and unfavorably. Patient A. L. (Figs. 6 and 7) had a severe basal malrelationship, marked overjet, and normal overbite. Response was immediate and gratifying, but the anterior spacing was a big help and the lack of excessive overbite was equally beneficial. Patient J. M. presented the same type of case, but with no anterior spacing (Figs. 8 and 9). Removal of maxillary second molars undoubtedly paved the way for the mesiodistal adjustment. Here, certainly, our answer to the question would be "yes" in every department.

Fig. 8.

Fig. 9.

Fig. 8.—Both basal dysplasia and overjet posed severe problems here, but overbite was normal.

Fig. 9.—Set of models taken two years after orthodontic therapy had been completed. Maxillary third molars had not erupted as yet.

It was soon found that extraoral anchorage alone was inadequate for control of vertical discrepancies in cases where overbite was excessive. Even with bite plate assistance, residual overbite remained after basal adjustment and overjet correction. For example, Patient H. F. responded immediately to appliance stimulus, but casts indicate a remaining overbite problem (Fig. 10). Of significance is the apparent lack of growth during treatment. Other cases with slight growth changes showed the same problem. Overbite correction was more favorable where there was no appreciable change in the inclination of the occlusal plane and where growth increments were favorable. This has been substantiated in a study of treated Class II, Division 1 malocclusions just completed by Hagihara[2] at Northwestern University. Nevertheless, overbite correction, with or without bite plate assistance, remains one of the most difficult treatment objectives, using extraoral force alone. Probably the lack of control over the curve of Spee is a major factor here, over and above the morphogenetic pattern.

In the permanent dentition group there was one common factor—growth. In nineteen boys and seventeen girls a clear correlation between pubertal growth spurt and response to mechanotherapy was evident. Twenty-five of the patients responded sufficiently well to answer our theoretical question in the affirmative with the elimination of Class II characteristics. Examples are given in Figs. 11, 12, 13, and 14.

Fig. 10.—Patient H. F. Correction with extraoral appliance still left excessive overbite and lingually inclined maxillary incisors.

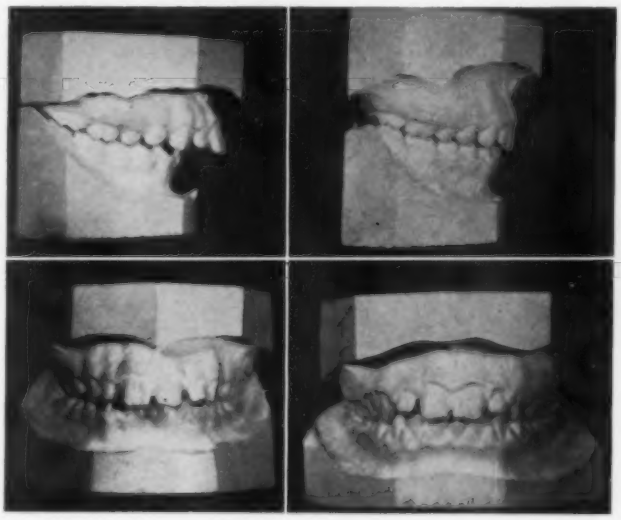

Fig. 11.—Patient J. N. Permanent dentition. Excellent growth increments were observable during orthodontic treatment.

From the foregoing, it is clear that correction of marked Class II, Division 1 malocclusions *can* be accomplished, provided there is a favorable combination of factors (growth and development, patient cooperation, etc.).

Fig. 12.

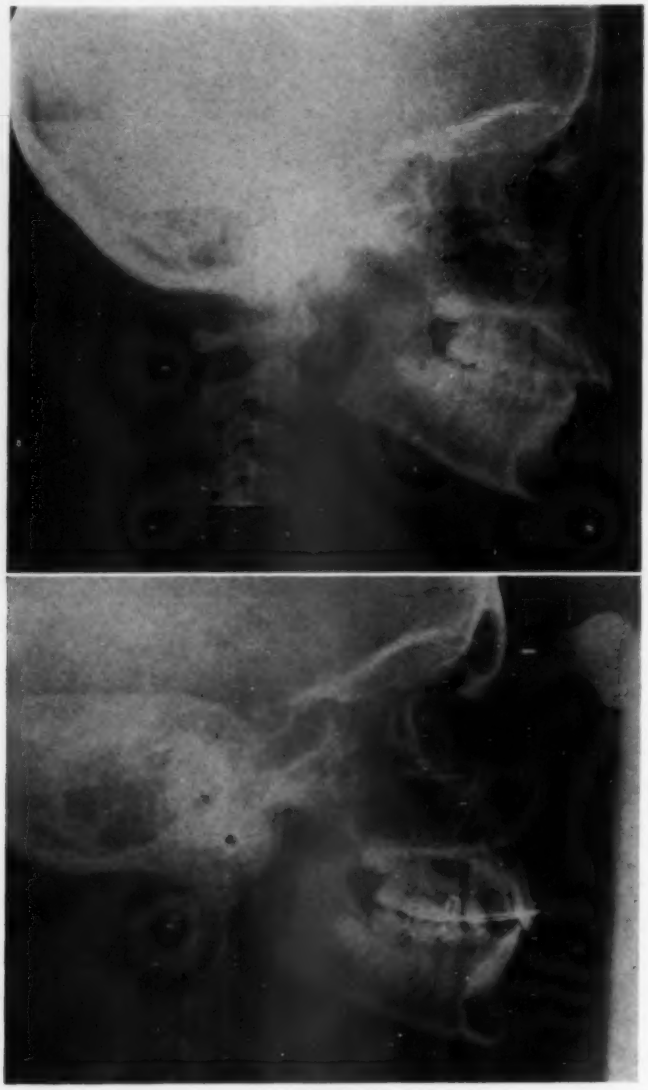

Fig. 13.

Fig. 12.—Patient J. K. Headplate taken prior to treatment shows marked malocclusion, with little spacing in anterior segment.

Fig. 13.—Good growth, plus space closure and distal movement of maxillary denture, effected this result.

2. *Does extraoral force withhold maxillary growth or maxillary alveolar growth, move teeth bodily distal, or merely tip teeth distally?* There is no evidence that maxillary growth, per se, is affected. This is conferred by sutures, primarily, and claims that maxillary growth is withheld still must come for-

ward with the evidence; we have yet to see it. That maxillary alveolar growth can be influenced is another matter, for the routine change in anteroposterior apical base relationship in our studies is one of the more significant observations. Cases such as that of Patient A. M. (Fig. 15) can be duplicated freely. The part of the question dealing with the distal bodily movement of maxillary first molars is more controversial. Categoric denial of this possibility is made in rather highly placed quarters. Nevertheless, there is evidence that bodily distal movement of maxillary first molars can be accomplished (not routinely,

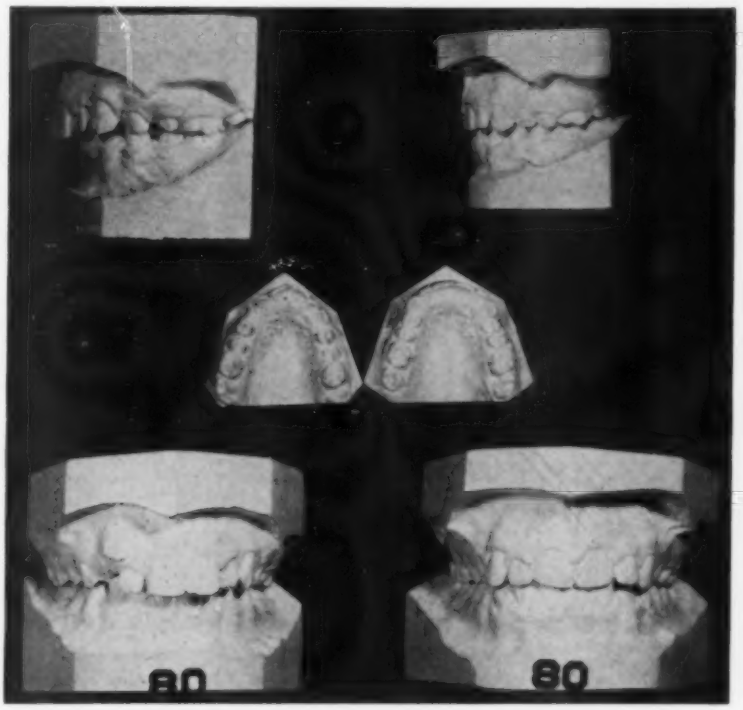

Fig. 14.—No mandibular appliances were placed. The maxillary arch wire was modified by the addition of an auxiliary spring to retract the upper right canine. Distal movement was accomplished by the cervical appliance.

to be sure). Occasionally, this may happen without any apparent reason (Fig. 16), or it can be predicted if maxillary second molars are removed during the course of active treatment. (Figs. 8 and 9). This is a subject in itself and is the basis of a report published in a recent issue of the AMERICAN JOURNAL OF ORTHODONTICS.[3] In most cases, the maxillary first molar is merely restrained from coming forward in its normal path or tipped distally. One of the disadvantages of extraoral appliances is the tendency in some cases toward the excessively distal tipping of first molars. This tendency can be reduced either by allowing the maxillary second molars to erupt first, by removal of the maxillary second molars, or (in the mixed dentition) by placing the bands or Rocky Mountain type crowns on the second deciduous molars instead of the first permanent molars. It is claimed that tipping is less likely with the headcap than with the cervical gear and that compensations for this tendency

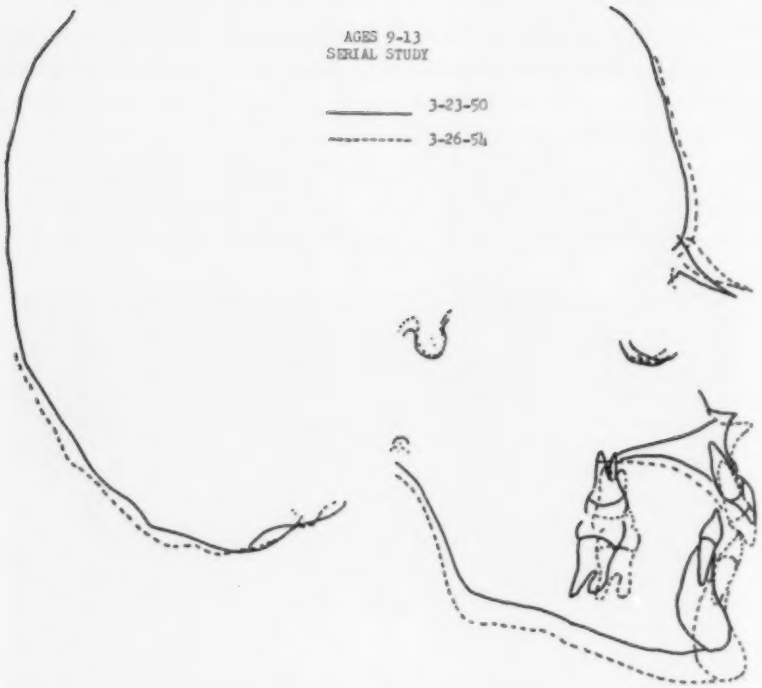

Fig. 15.—Serial tracings, showing usual response to extraoral force. There were a number of cases where maxillomandibular adjustment was even more marked.

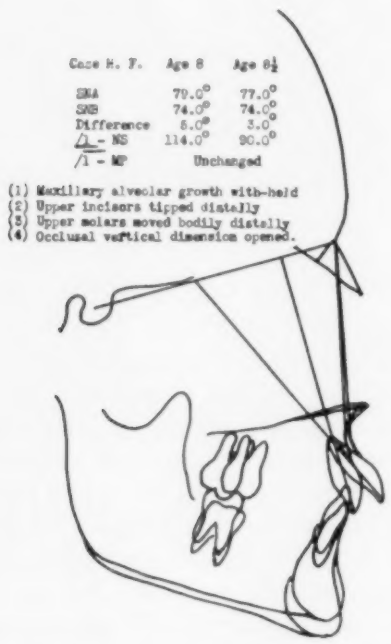

Fig. 16.—Class II correction was rapid in this case, despite lack of evidence of any appreciable growth during treatment.

can be made by bending the labial bow in a certain manner. It is here that the dentist's inherent mechanical ingenuity comes to the fore, along with his love for gadgetry. One of our cases was outstanding because of complete failure over a three and one-half-year span. Other than the fact that the patient was the daughter of a dentist, several reasons can be advanced. First, the morphogenetic pattern is that of a dolichocephalic type face, with severe Class II relationship in the father (Fig. 17). Second, there was no growth during the span of active therapy. Third, and I suspect this operated to a

A. *B.*

Fig. 17.—Facial type, severe basal malrelationship and lack of growth combined in this case and orthodontic therapy was unsuccessful.

greater or lesser degree in our cases that did not work out as well as we would like, patient cooperation was sporadic. Despite the convenience and attractiveness of using the last factor as an excuse, however, there was good scientific basis for the failure (Figs. 18 and 19).

3. *Does extraoral force tip maxillary incisors lingually, moving apices labially?* It already has been shown that lingual tipping is of constant concern in the maxillary incisor region. To establish a normal overjet with a marked basal dysplasia, how can incisor function be obtained unless it is by the elimination of the maxillomandibular basal malrelationship? Despite excellent results in reducing the anteroposterior discrepancy, it is all too apparent that remaining apical base differences present overjet problems that are correctable only by excessive lingual inclination of the maxillary incisors, excessive labial inclination of the mandibular incisors, or both (Figs. 5 and 10). It has been our policy to disturb the balance of the lower incisor to basal bone as little as possible, keeping axial inclination constant, as we believe that between lingual tipping of the maxillary incisors and labial tipping of the mandibular incisors, the former is the lesser evil. It is vital, however, that we recognize the need for compromise somewhere. We cannot choose to ignore basal malrelationship, naïvely pitting upper and lower teeth against each other in the hope of

an "automatic" adjustment. We learn this lesson, not from the glowing "chamber of commerce" reports presented at meetings, but from the salt mines in our offices.

Fig. 18.

Fig. 19.

Fig. 18.—Patient M. B. Lateral headplate before treatment.

Fig. 19.—Patient M. B. Lateral headplate three and one-half years later. There has been little mandibular growth. Overjet and overbite have increased despite extraoral force applied during the three-and-one-half-year period.

4. *Does extraoral force, directed as it is against the maxillary first molar, impact maxillary second or third molars?* It is not possible to give a simple "yes" or "no" here. In general, the answer can be "no," judging from our

sample of 100 treated cases plus continuing observation of many other cases. It is possible to impact maxillary second molars *temporarily* by excessive distal tipping of first molars, but with the removal of the distal force the first molars usually upright themselves, permitting eruption of the maxillary second molars. However, several cases have been observed where the second molars have erupted to the buccal, in obvious cross-bite. While we cannot say that this is definitely due to the appliance therapy, there is a good likelihood that this is the cause. I have seen four bona fide cases of noneruption of maxillary second molars after extraoral mechanotherapy. This, plus the diverting of the second molar from its normal path of eruption and the probable like influence on the maxillary third molar, requires some careful consideration. It would appear, on the basis of our observations of a large number of cases, that there is only so much room available in the alveolar trough. After this is used

Fig. 20.—Patient S. E. As shown by the tracing, excellent growth in the treatment period, even at 19 years of age, can give appreciable help in the correction of a Class II relationship.

up through distal appliance stimulus, no more can be gained except by causing the teeth to move buccally or lingually or by impacting teeth as yet unerupted. But the problem is not that simple. Growth is all-important. If increments are good, the withholding of the maxillary alveolodental complex in a downward- and forward-growing face can permit adjustment of the anteroposterior discrepancy with minimum contributions from tooth adjustment. The $64.00 question is: how much can we depend on growth? We do not know the answer as yet, but it makes eminently good sense to treat while growth is precipitate, namely, during the pubertal growth spurt. Our studies of the three groups (deciduous, mixed, and permanent dentitions) show conclusively that the best results were obtained in girls from 10 to 13 years of

age and in boys from 12 to 17 years, although in one case of a 19-year-old boy, who grew 2 inches in six months, mandibular growth was excellent and the Class II relationship was corrected (Fig. 20).

A corollary to this is the question of unilateral response to extraoral force. This was indeed observed (Figs. 21 and 22) and it posed a problem, particularly in the canine region. In seven of the 100 cases studied, a lower lingual appliance was placed for elastic traction during the time when extraoral force was not active. In five of these, there was unilateral response. A number of

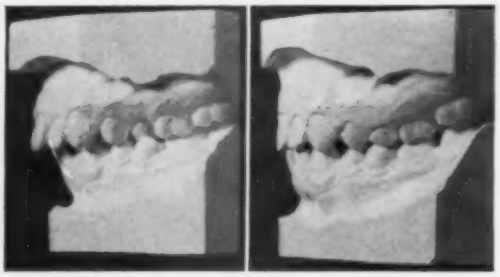

Fig. 21. Fig. 22.

Fig. 21.—Class II, Division 1 malocclusion. Extraoral appliance was worn for thirty months, with results seen in Fig. 22.

Fig. 22.—Same case as shown in Fig. 21. Despite improvement in overjet, a Class II relationship still remains in the left buccal segment.

other cases were terminated with one segment still not adequately locked, despite normal molar relationship. No definite reason can be advanced. Careful questioning of the patients disclosed two possibilities: (1) A number of them said that they slept on one side all the time. This appeared, inconclusively, to be the side that moved least. (2) Others said that they favored one side when they ate, and this appeared, inconclusively, to be the side that moved least well. This question must remain unanswered and a challenge for the present.

5. *Does extraoral force free occlusal interferences, allowing the mandible to come forward? Does it stimulate forward positioning on the basis of a neurogenic reflex posture mechanism, as claimed in some quarters? Does it stimulate mandibular growth by removing all restrictions?* We all eagerly await impartial evidence showing that any orthodontic appliance makes the mandible grow any more than it is going to, according to the morphogenetic pattern. Studies showing *seeming acceleration* and *apparent growth rate increase* by such mechanisms as guide planes and similar appurtenances have been duplicated at Northwestern University. Our results do not duplicate those claimed. Extraoral force can change inclined plane relations of maxillary and mandibular teeth. Where there is mandibular overclosure and a resultant functional retrusion due to tooth guidance, this can be eliminated quite satisfactorily by combined extraoral force and a bite plate. However, functional retrusions are of neither the frequency nor the degree once thought. No Class II malocclusion becomes a Class I through elimination of distal displacement. As to repositioning the mandible, through a neurogenic mechanism or any other, let

us analyze all diagnostic criteria and records and duplicate the experiment under controlled conditions, with a biometric analysis. We do not say categorically, "It cannot happen." There is no "never" in physiology and we are as anxious to see it as you are. I do not speak facetiously when I point out that most progress in orthodontics has come from the clinician, with the role of institutions largely of a substantiative and confirmatory nature, but many claims made by clinicians in the past have not stood up under impartial scrutiny.

SUMMARY

1. Class II, Division 1 malocclusions are amenable to correction by the use of extraoral force. Marked improvement in basal relations can be obtained; overbite and overjet problems can be helped greatly.

2. The initial pattern, the relationship and degree of basal malrelationship, overbite, and overjet, and the unpredictable amount of growth definitely influence the results.

3. Despite the unpredictability of growth, it is an important factor. Its presence or absence profoundly influences the results. Coordination of treatment with the pubertal growth spurt means a greater likelihood of success. This means that the best results are likely to be obtained between the ages of 10 and 12 years in girls and 12 and 17 years in boys.

4. Certain untoward sequelae may be seen in the use of extraoral force. These include incomplete correction of tooth malrelationship, excessive distal tipping of maxillary first molars, possible impaction of maxillary second or third molars, possible excessive lingual tipping of maxillary incisors, possible unilateral response in correction of Class II relationship, and difficulty in the control of excessive overbite.

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A SURVEY OF CURRENT PRACTICE PROCEDURES

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THE orthodontist with a few years of experience in the specialty is beset by many possible procedures which he may follow, and yet his background may leave an area of doubt and hesitancy as to the value of adopting some of them.

In many cases, after attending orthodontic meetings, we return to our practices stimulated with the ideas and suggestions presented there. In the process of digesting these suggestions and considering the wisdom of instituting some of them in practice, we may find that many of them are thought to be of doubtful value by men of greater experience. A specific example of this problem is the recommendation of the value of mixed dentition treatment. As a matter of fact, this question was the basis of thought behind this survey.

A questionnaire was undertaken as a means of determining the attitude of the orthodontic profession in some of these matters. We all hesitate to adopt a procedure that several years later may prove to have been unworthy of the effort, and yet it is impossible to predetermine the value of such procedures. Where can we find an area of agreement that will give the neophyte the benefit of experience and judgment? Hence, it was felt that a survey of practice procedures might shed some light on these problems. Once the course was set and a questionnaire was in preparation, other problems arose. It was determined that, for a survey of this type, enough men should be approached to assure sufficient response for statistical value. Questions other than those concerned with mixed dentition treatment were included, as it was thought that they might supply information which would interest the orthodontic group.

This questionnaire was mailed to 1,000 orthodontists in exclusive practice of the specialty. The mailing list was prepared from the *Orthodontic Directory of the World* (1952 edition). The response was truly gratifying and approached a 50 per cent return. I have been told by those who have experience in the field of polling that this high percentage of returns is most unusual. Of 465 questionnaires returned, 441 were used in the tabulation of results. Thirteen were returned for such reasons as "deceased," "retired," or "unable to deliver," and eleven were returned after the compilation was so far advanced that it was

This thesis, which was given as a partial fulfillment of the requirements for certification by the American Board of Orthodontics, is being published with the consent and the recommendation of the Board, but it should be understood that it does not necessarily represent or express the opinion of the Board.

Read before the Northeastern Society of Orthodontists, New York City, March, 1955.

impossible to include them. Many were returned with accompanying letters or comments which were very interesting and which would be worth while including if space permitted.

A sample of the questionnaire, with the accompanying letter, is shown in Fig. 1.

Let us now consider the answers to this survey. It was decided to consider the replies from two aspects: (1) from the aspect of geographical location, to see if there might be geographical differences in procedures of practice, and (2) from the aspect of number of years in practice, to see if there would be a trend of methods with more years of experience. These two considerations, then, were the basis for the breakdown of the survey.

Considerable thought was given to making the questions uncomplicated and easy to answer, since the men receiving this questionnaire are busy and, at best, it was an imposition on their time. As a result of this simplification and other factors, three of the questions were found unsuitable to use in computation. These were questions 20, 21, and 22, dealing with millimeters of crowding and months of retention in extraction and nonextraction cases. Consequently, these questions have not been included in this article.

The last three questions in the survey, Nos. 23, 24, and 25, have not been tabulated in the article, since the replies were almost unanimous. Following is the breakdown of these answers in brief.

Question 23. Are there facilities for the rehabilitation of cleft palate patients in the area in which you practice?

Approximately 92 per cent of the replies showed that facilities were available in the area, 5 per cent could be accommodated at a reasonable distance, and 3 per cent showed no facilities available.

Question 24. Do you recommend the topical application of fluoride to your patients?

Only 2 per cent of the men answering were not in favor of topical fluoride. The remaining 98 per cent either recommended this procedure or did not object to it, although they did not specifically recommend application. Included in this 98 per cent are those answers from areas where the community water supply is either naturally or artificially fluoridated. These men felt that they had no reason to recommend topical application, although they approved of the procedure, where indicated.

Question 25. Do you favor fluoridation of communal water supplies?

The replies in regard to fluoridation showed 95 per cent of the men to favor this procedure; 5 per cent said that they were opposed, but many qualified their answers by stating that they wished to see the results of more study. Many men from areas where there is natural fluoride in the water were enthusiastic in their comments concerning the condition of children's teeth in their areas.

August 15, 1953

Dear Doctor:

This questionnaire is being submitted to one thousand orthodontists in exclusive practice to gather material for a thesis which will be submitted to the American Board of Orthodontics.

No effort is being made to establish the source of the replies other than general geographic location.

I realize that some of the questions might be considered controversial, but I do hope that they will not prove offensive. The thought behind this effort is to establish what a cross section of the orthodontic profession is actually doing in the routine conduct of practice.

Your cooperation in answering the questions herein will be appreciated. If possible a reply prior to October 1, 1953, will be helpful.

A postage paid envelope is enclosed for your convenience in returning the questionnaire.

Thank you for your help.

Cordially yours,
Robert C. Germond, D.D.S.

1. Of which component society of the American Association of Orthodontists are you a member? _____
2. How many years have you been in the exclusive practice of orthodontics?
   1 to 5 yrs. ☐ 5 to 10 yrs. ☐ 10 to 15 yrs. ☐ 15 to 25 yrs. ☐ Over 25 yrs. ☐
3. How many assistants do you employ? (Technicians, Secretaries, etc.) _____
   Comment: _____
4. Approximately how many patients do you have under active treatment at any one time? _____
   Comment: _____
5. Do you use myofunctional therapy in your practice? Yes ☐ No ☐
   Comment: _____
6. If answer to No. 5 is yes, in what per cent of cases is it advocated? _____%
   Comment: _____
7. In what per cent of the cases that you have under treatment are you using the following type of technique?
   Labiolingual_____ %
   Johnson twin arch_____ %
   Edgewise arch_____ %
   Universal_____ %
   Combination of _____ %
   Other (please specify) _____ %
   Comment: _____
   _____
8. Do you have equipment for cephalometric procedures? Yes ☐ No ☐
   Comment: _____
9. If answer to No. 8 is yes, in what per cent of cases do you use it routinely? _____ %
10. Do you have equipment for photographic procedures? Yes ☐ No ☐
    Comment: _____
11. If answer to No. 10 is yes, in what per cent of cases do you use it routinely? _____ %
    Comment: _____
12. Do you treat cases in mixed dentition with appliance therapy? Yes ☐ No ☐
    Comment: _____
13. Do you treat Class I cases in mixed dentition with appliance therapy which have as their only defect anterior crowding of less than 4 millimeters? Yes ☐ No ☐
    Comment: _____

(Continued.)

14. Do you treat Class I cases in mixed dentition with appliance therapy which have as their only defect anterior crowding in excess of 4 millimeters? Yes ☐ No ☐
Comment: ---

15. Do you treat Class II cases in mixed dentition? Yes ☐ No ☐
Comment: ---

16. If answer to No. 15 is yes, in what per cent of cases do you use Class II mechanics (namely, intermaxillary elastic force)? ---------- %
Comment: ---

17. If answer to No. 15 is yes, in what per cent of cases do you use the headcap treatment? ---------- %
Comment: ---

18. Would you treat more mixed dentition cases if the time were available? Yes ☐ No ☐
Comment: ---

19. Do you advocate serial extractions where crowding is excessive in the mixed dentition? Yes ☐ No ☐
Comment: ---

20. How many millimeters of crowding is present in the mandibular arch before you consider extraction of teeth in the treatment of a Class I case in the permanent dentition?
1 mm. 2 mm. 3 mm. 4 mm. 5 mm. 6 mm. 7 mm. 8 mm. 9 mm.
Comment: ---

21. How long do you retain the mandibular arch in nonextraction cases? ---------- months
Comment: ---

22. How long do you retain the mandibular arch in extraction cases? ---------- months
Comment: ---

23. Are there facilities for rehabilitation of cleft palate patients in the area in which you practice? Yes ☐ No ☐
Comment: ---

24. Do you recommend topical application of fluoride to your patients? Yes ☐ No ☐
Comment: ---

25. Do you favor fluoridation of communal water supplies? Yes ☐ No ☐
Comment: ---

NOTE: This space is for any additional comment you may have.

Fig. 1.

The remaining nineteen questions are considered in detail in the analysis of the replies. As previously mentioned, the first two questions are the basis of the breakdown of the remainder of the survey: (1) by geographical area, as indicated by the reply to the first question ("of which component society of the American Association of Orthodontists are you a member?"), and (2) by the number of years in the exclusive practice of orthodontics, as shown by the answer to the second question.

Tables I, II, and III show the detailed statistics of the answers to these nineteen questions. These tables show what each of the five age groups in each of the eight component societies answered to the questionnaire. Although these tables are not used in the analysis of the survey, they may be of interest to some, as they show the practice procedures of five age groups in the eight societies. By consulting these tables, a person could compare his practice procedures with those of other men in similar circumstances, and this might prove stimulating.

TABLE I. RESULTS CONCERNING PRACTICE PROCEDURES (PERCENTAGES)

AREA	YEARS IN PRACTICE	REPLIES	#3 NUMBER OF ASSISTANTS	#4 ACTIVE PATIENTS	#5 MYOFUNCTIONAL THERAPY YES	#5 MYOFUNCTIONAL THERAPY NO	#6 MYOFUNCTIONAL THERAPY USED	#8 CEPHALOMETRIC YES	#8 CEPHALOMETRIC NO	#9 CEPHALOMETRIC PROCEDURES USED	#10 PHOTOGRAPHIC EQUIPMENT YES	#10 PHOTOGRAPHIC EQUIPMENT NO	#11 PHOTOGRAPHIC PROCEDURES USED
North-eastern	1-5	13	1	105	54	46	9	77	23	80	92	8	93
	5-10	37	1.7	114	73	27	10	60	40	88	97	3	95
	10-15	10	1.9	150	50	50	52	20	80	12	100	0	72
	15-25	17	1.7	107	30	70	17	35	65	54	90	10	88
	25+	14	2.5	120	79	21	35	43	57	60	100	0	90
Middle Atlantic	1-5	2	1	103	50	50	5	0	100	0	100	0	100
	5-10	4	1.5	134	75	25	30	50	50	45	100	0	98
	10-15	3	0.7	103	100	0	73	33	66	100	100	0	66
	15-25	7	2	164	70	30	23	43	57	71	100	0	80
	25+	6	1.7	237	83	17	14	33	66	10	66	33	61
Great Lakes	1-5	9	1	84	76	24	45	33	66	85	100	0	83
	5-10	9	1.2	106	55	45	8	33	66	100	100	0	90
	10-15	12	1.5	143	75	25	22	42	58	46	84	16	83
	15-25	15	1.8	114	80	20	38	53	47	71	100	0	94
	25+	7	2.2	131	30	70	55	14	86	50	100	0	94
Central	1-5	9	1.5	102	44	56	33	33	66	90	90	10	70
	5-10	21	1.7	124	71	29	17	38	62	98	90	10	82
	10-15	17	1.5	163	70	30	31	24	76	99	87	13	92
	15-25	18	2.2	147	72	28	21	33	66	84	88	12	94
	25+	7	1	101	57	43	11	0	100	0	30	70	80
Southern	1-5	12	1.2	118	50	50	32	25	75	100	83	17	83
	5-10	12	1.7	146	86	14	12	25	75	30	86	14	75
	10-15	8	2.5	186	75	25	8	17	83	66	83	17	75
	15-25	15	2	169	60	40	35	33	66	60	93	7	88
	25+	8	2.2	222	50	50	6	25	75	8	75	25	98
Rocky Mountain	1-5	3	1	83	100	0	18	0	100	0	100	0	12
	5-10	5	1.2	83	100	0	30	40	60	99	80	20	100
	10-15	1	0	27	100	0	80	0	100	0	0	100	0
	15-25	3	1	83	100	0	36	0	100	0	75	25	57
	25+	2	2	137	100	0	7	0	100	0	100	0	100
South-western	1-5	5	1.6	82	100	0	18	80	20	55	80	20	97
	5-10	13	1.4	126	54	46	14	23	77	91	92	8	95
	10-15	7	2	124	86	14	26	43	57	100	100	0	98
	15-25	6	2.5	147	83	17	15	17	83	75	100	0	75
	25+	8	1.2	135	75	25	10	0	100	0	50	50	40
Pacific	1-5	17	1.2	100	70	30	25	47	53	70	88	12	91
	5-10	34	1.6	111	60	40	21	21	79	53	92	8	95
	10-15	11	1.4	139	64	36	20	64	36	75	100	0	75
	15-25	24	1.5	116	80	20	11	20	80	100	80	20	80
	25+	10	1.3	87	100	0	30	30	70	71	70	30	87

TABLE II. RESULTS CONCERNING MIXED DENTITION PROCEDURES (PERCENTAGES)

TABLE II. RESULTS CONCERNING MIXED DENTITION PROCEDURES (PERCENTAGES)

AREA	YEARS IN PRACTICE	REPLIES	#12 TREAT ANY		#13 CLASS I LESS THAN 4 MM.		#14 CLASS I IN EXCESS OF 4 MM.		#15 CLASS II		#16 ELASTIC	#17 HEAD-CAP	#18 MORE IF TIME		#19 SERIAL EXTRACT	
			YES	NO	YES	NO	YES	NO	YES	NO			YES	NO	YES	NO
North-eastern	1-5	13	77	23	15	85	70	30	94	6	39	65	20	80	92	8
	5-10	37	94	6	9	91	13	87	84	16	25	63	20	80	80	20
	10-15	10	100	0	10	90	40	60	90	10	66	26	40	60	60	40
	15-25	17	94	6	23	77	18	82	71	29	44	58	20	80	50	50
	25+	14	100	0	21	79	7	93	79	21	86	12	21	79	86	14
Middle Atlantic	1-5	2	100	0	100	0	50	50	100	0	50	50	50	50	50	50
	5-10	4	100	0	0	100	50	50	75	25	22	62	25	75	50	50
	10-15	3	100	0	33	66	33	66	100	0	35	65	33	66	33	66
	15-25	7	100	0	30	70	30	70	86	14	66	10	53	57	86	14
	25+	6	100	0	0	100	17	83	83	17	62	21	50	50	66	33
Great Lakes	1-5	9	100	0	10	90	33	66	90	10	26	80	10	90	90	10
	5-10	9	100	0	22	78	33	66	90	10	28	56	88	22	55	45
	10-15	12	92	8	8	92	17	83	66	33	23	65	8	92	84	16
	15-25	15	100	0	14	86	20	80	90	10	10	76	20	80	90	10
	25+	7	86	14	0	100	0	100	86	14	50	50	30	70	30	70
Central	1-5	9	100	0	45	55	45	55	100	0	46	49	56	44	100	0
	5-10	21	100	0	38	63	48	52	100	0	46	46	29	71	79	21
	10-15	17	100	0	35	65	47	53	90	10	46	45	47	53	76	13
	15-25	18	100	0	33	66	45	55	94	6	38	50	28	72	72	28
	25+	7	100	0	43	57	30	70	100	0	83	14	57	43	14	86
Southern	1-5	12	100	0	17	83	75	25	100	0	55	36	33	66	83	17
	5-10	12	92	8	25	75	33	66	83	17	55	35	42	58	50	50
	10-15	8	100	0	25	75	62	38	75	25	64	2	38	62	62	38
	15-25	15	100	0	26	74	53	47	100	0	77	27	26	74	74	26
	25+	8	100	0	14	86	62	38	100	0	70	20	25	75	50	50
Rocky Mountain	1-5	3	100	0	33	66	33	66	66	33	52	3	33	66	66	33
	5-10	5	100	0	20	80	60	40	80	20	57	44	40	60	60	40
	10-15	1	100	0	-	-	-	-	100	0	-	-	-	-	-	-
	15-25	3	100	0	0	100	66	33	66	33	60	47	0	100	33	66
	25+	2	50	50	0	100	0	100	50	50	0	0	0	100	50	50
South-western	1-5	5	100	0	20	80	40	60	80	20	2	25	40	60	80	20
	5-10	13	76	24	8	92	24	76	62	38	42	53	24	76	54	46
	10-15	7	100	0	14	86	29	71	86	14	53	43	0	100	57	43
	15-25	6	100	0	17	83	0	100	50	50	68	2	17	83	100	0
	25+	8	100	0	25	75	75	25	75	25	100	2	37	63	37	63
Pacific Coast	1-5	17	94	6	35	65	47	53	94	6	41	48	35	65	100	0
	5-10	34	100	0	24	76	76	24	88	12	33	66	40	60	84	16
	10-15	11	90	10	45	55	36	64	90	10	44	49	64	36	90	10
	15-25	24	96	4	30	70	38	62	92	8	43	36	33	66	90	10
	25+	10	100	0	10	90	90	10	100	0	43	22	60	40	60	40

TABLE III. RESULTS CONCERNING TECHNIQUE TYPE (PERCENTAGES)

AREA	YEARS IN PRACTICE	REPLIES	LABIO-LINGUAL	JOHNSON TWIN ARCH	EDGEWISE ARCH	UNIVERSAL APPLIANCE	COMBINATIONS AND REMOVABLES
Northeastern	1-5	13	14	33	47	0	8
	5-10	37	7	27	57	2	7
	10-15	10	33	35	30	2	0
	15-25	17	25	26	46	0	3
	25+	14	36	21	37	0	6
Middle Atlantic	1-5	2	50	35	13	0	2
	5-10	4	16	40	36	0	8
	10-15	3	4	28	63	0	5
	15-25	7	34	43	17	0	6
	25+	6	63	36	1	0	0
Great Lakes	1-5	9	9	28	59	0	4
	5-10	9	3	48	38	0	11
	10-15	12	13	39	45	0	3
	15-25	15	11	9	68	1	11
	25+	7	1	45	46	2	6
Central	1-5	9	8	40	38	11	3
	5-10	21	11	22	51	2	14
	10-15	17	15	32	47	1	5
	15-25	18	14	32	45	0	9
	25+	7	54	15	31	10	0
Southern	1-5	12	20	45	20	15	0
	5-10	12	32	46	14	4	4
	10-15	8	36	30	5	14	15
	15-25	15	26	49	22	0	3
	25+	8	32	40	12	0	16
Rocky Mountain	1-5	3	0	10	12	78	0
	5-10	5	4	60	24	0	12
	10-15	1	Not Computable				
	15-25	3	29	8	33	0	30
	25+	2	0	50	0	0	50
Southwestern	1-5	5	22	2	60	2	14
	5-10	13	15	22	54	8	1
	10-15	7	52	7	40	0	1
	15-25	6	50	37	9	1	3
	25+	8	36	32	3	0	29
Pacific Coast	1-5	17	3	12	70	7	8
	5-10	34	5	10	68	9	8
	10-15	11	1	0	53	36	10
	15-25	24	7	10	40	33	10
	25+	10	15	3	38	42	2

This article is based on the consolidation of these tables into two categories: (1) geographical area, as shown in Tables IV, V, and VI, and (2) years of practice, as found in Tables VII, VIII, and IX.

I do not claim to be a statistical expert. For the purposes of accuracy in computing the percentages as expressed in the breakdown of this survey, a statistician was consulted. It was his opinion that the statistical methods employed in arriving at the weighted averages are correct. All the answers in the recapitulation tables are weighted.

A brief explanation of a weighted average might be in order at this point. When several averages are combined into one, the number of replies is considered so that each group carries only its own weight in the combined average.

As an example of the application of this technique in the computation for this article, we will take question 5 and show how the percentages are combined from Table I to Table IV for the Northeastern group:

The 1- to 5-year group had 13 replies, with 54 per cent "yes." The 54 is multiplied by 13. The 5- to 10-year group had 37 replies, with 73 per cent "yes." The 73 is multiplied by 37. This is done for each age group and the totals are added. Then the total of percentages is divided by the total number of replies, which in this case was 91. The answer is 61 per cent. The same technique is employed for the "no" answers as a cross check for accuracy. These answers, then, of 61 per cent "yes" and 39 per cent "no" are considered to be weighted averages.

This procedure was followed in all the statistical work for the tables of answers.

The most concise way to review these statistics seems to be to consider each question, individually, and each category, successively, under each question.

Question 3. How Many Assistants Do You Employ?

Geographically.—As can be seen in Table IV, the consistency of the averages is very marked. Four of the eight groups were identical, with 1.7 assistants. The other four groups were very close to this figure, with 1.5, except for the Rocky Mountain group, which showed 1.2 assistants.

Years of Practice.—As might be expected, there is a gradual increase in the number of assistants with more years of practice (see Table VII). The 1- to 5-year group averages 1.36 aides, and there is a gradual build-up to 1.84 in the 15- to 25-year group, followed by a slight decrease to 1.8 assistants in the over-25-year category.

Question 4. How Many Active Patients Do You Have Under Treatment At Any One Time?

Geographically.—Here we find considerable variation from a low average of 87 patients in the Rocky Mountain group to a high of 165 patients in the Middle Atlantic and Southern Societies. This difference might be traced to one man in the Rocky Mountain group who, because of illness, has only 27 patients, whereas in the Southern Society there is one age group averaging 222 patients. Also, in the Middle Atlantic group there is one age bracket that averages 237 patients per man.

These wide differences in small groups do not bear as much influence on the combined average as one might think at first glance, since the combined averages throughout the compilation are weighted averages.

Years of Practice.—The 1- to 5-year group averaged 100 active patients, which was the smallest number, and the 10- to 15-year group was the highest, with 148 patients per man. We see that the patient load rose to a peak in the 10- to 15-year group, and then in the 15- to 25-year group falls off to an average of 130 patients, only to increase again to 140 active patients per man in the over-25-year group.

RECAPITULATION OF TABLES BY GEOGRAPHICAL AREA

TABLE IV. PRACTICE PROCEDURES

AREA	REPLIES	#3 NUMBER OF ASSISTANTS	#4 ACTIVE PATIENTS	#5 MYOFUNCTIONAL THERAPY		#6 MYOFUNCTIONAL USED	#8 CEPHALOMETRIC		#9 CEPHALOMETRIC PROCEDURES USED	#10 PHOTOGRAPHIC EQUIPMENT		#11 PHOTOGRAPHIC PROCEDURES USED
				YES	NO		YES	NO		YES	NO	
Northeastern	91	1.7	116.3	61	39	20	51	49	68	96	4	90
Middle Atlantic	22	1.6	164.6	77	23	27	36	64	47	91	9	78
Great Lakes	52	1.5	116.4	67	33	33	38	62	70	96	4	87
Central	72	1.7	134.1	66	34	23	29	71	85	83	17	86
Southern	55	1.7	164.0	63	37	21	25	75	58	84	16	84
Rocky Mountain	14	1.2	87.0	100	0	29	14	86	35	80	20	65
Southwestern	39	1.7	125.4	74	26	16	28	72	67	85	15	81
Pacific	96	1.5	111.0	71	29	20	31	69	72	87	13	87

TABLE V. MIXED DENTITION PROCEDURES

AREA	REPLIES	#12 TREAT ANY		#13 CLASS I LESS THAN 4 MM.		#14 CLASS I IN EXCESS OF 4 MM.		#15 CLASS II		#16 ELASTIC	#17 HEADCAP	#18 MORE IF TIME		#19 SERIAL EXTRACT	
		YES	NO	YES	NO	YES	NO	YES	NO			YES	NO	YES	NO
Northeastern	91	93	7	14	86	24	76	83	17	44	50	22	78	75	25
Middle Atlantic	22	100	0	50	50	32	68	86	14	51	34	41	59	64	36
Great Lakes	52	96	4	11	89	21	79	84	16	24	67	29	71	74	26
Central	72	100	0	37	63	38	62	96	4	48	44	39	61	73	27
Southern	55	98	2	22	78	56	44	93	7	64	26	33	67	65	35
Rocky Mountains	14	93	7	14	86	43	57	71	29	44	26	21	79	50	50
Southwestern	39	92	8	15	85	34	66	69	31	55	29	23	77	61	39
Pacific	96	97	3	28	72	32	68	92	8	39	49	42	58	87	13

TABLE VI. TECHNIQUE TYPE

AREA	REPLIES	LABIO-LINGUAL	JOHNSON TWIN ARCH	EDGEWISE ARCH	UNIVERSAL APPLIANCE	COMBINATIONS AND REMOVABLES
Northeastern	91	18.7	27.6	47.5	1.03	5.5
Middle Atlantic	22	35.8	37.8	22.0	0.0	4.0
Great Lakes	52	8.4	30.8	52.3	0.6	7.3
Central	72	16.5	28.4	45.1	2.2	7.9
Southern	55	28.3	43.4	15.9	6.2	6.2
Rocky Mountain	14	8.2	34.9	19.6	18.0	19.2
Southwestern	39	32.2	21.9	35.1	3.1	8.7
Pacific	96	5.7	8.5	56.5	21.2	8.1

RECAPITULATION OF TABLES BY YEARS OF PRACTICE

TABLE VII. PRACTICE PROCEDURES

YEARS OF PRACTICE	REPLIES	#3 NUMBER OF ASSISTANTS	#4 ACTIVE PATIENTS	#5 MYO-FUNCTIONAL THERAPY		#6 MYO-FUNCTIONAL THERAPY USED	#8 CEPHALOMETRIC		#9 CEPHALOMETRIC PROCEDURES USED	#10 PHOTOGRAPHIC EQUIPMENT		#11 PHOTOGRAPHIC PROCEDURES USED
				YES	NO		YES	NO		YES	NO	
1-5	70	1.36	100.3	64	36	25	44	56	75	90	10	84
5-10	135	1.59	117.8	68	32	15	37	63	79	93	7	89
10-15	69	1.7	147.9	72	28	31	35	65	64	91	9	81
15-25	105	1.84	130.5	68	32	23	32	68	74	90	10	86
25+	62	1.8	140.7	71	29	24	23	77	33	74	26	81

TABLE VIII. MIXED DENTITION PROCEDURES

YEARS OF PRACTICE	REPLIES	TREAT ANY		CLASS I LESS THAN 4 MM.		CLASS I IN EXCESS OF 4 MM.		CLASS II		ELASTIC	HEAD-CAP	MORE IF TIME		SERIAL EXTRACT	
		YES	NO	YES	NO	YES	NO	YES	NO			YES	NO	YES	NO
1-5	70	94	6	27	73	53	47	93	7	40.1	49.8	33	67	90	10
5-10	135	95	5	20	80	29	71	85	15	35.9	56.5	34	66	72	28
10-15	69	97	3	24	76	39	61	84	16	46.2	41.4	35	65	71	29
15-25	105	98	2	25	75	34	66	86	14	45.9	34.5	26	74	77	23
25+	62	97	3	15	85	26	74	87	13	69.3	18.4	37	63	53	47

TABLE IX. TECHNIQUE TYPE

YEARS	REPLIES	LABIO-LINGUAL	JOHNSON TWIN ARCH	EDGEWISE ARCH	UNIVERSAL APPLIANCE	COMBINATIONS AND REMOVABLES
1-5	70	11.9	27.1	46.8	9.2	5.39
5-10	135	10.0	26.2	51.6	4.3	7.97
10-15	69	21.0	25.1	39.6	7.9	5.41
15-25	105	19.3	25.5	40.1	7.74	7.74
25+	62	32.0	26.4	25.2	7.00	9.77

Thus it is evident that the middle group, namely, 10 to 15 years of exclusive practice, is caring for more patients than any other group.

The averages in the remainder of the questions, 5 through 19, are expressed in percentages.

Question 5. Do You Use Myofunctional Therapy In Your Practice?

Geographically.—The average of percentages for "yes" answers to this question varied from 61 per cent to 100 per cent, as can be seen in Table IV. Except for the Rocky Mountain Society, in which 100 per cent of the men use some myofunctional therapy in their practices, the range was from 61 per cent to 77 per cent, which is not a tremendous variation. Most of the men use this therapy as an adjunct to appliance therapy, and many specifically mentioned swallowing and tongue thrusting habits as an indication for the application of myofunctional therapy.

In this question, as with the other "yes and no" questions, the "no" answers are an inverse percentage of the "yes" answers.

Years of Practice.—The "yes" answers in this category are in a very close range, from 64 per cent to 72 per cent. Apparently, there is no significant difference in the amount of myofunctional therapy used, either in different sections of the country or in various age groups.

There is slightly less usage in the youngest (1- to 5-year) group, but only 8 per cent less than the 10 to 15-year group, which employs myofunctional therapy 72 per cent.

Question 6. If You Use Myofunctional Therapy, in What Percentage of Cases Is It Advocated?

Geographically.—The answers to this question represent the percentages of cases in which myofunctional therapy is utilized by the men who do use it. The lowest percentage was 16 per cent in the Southwestern group, and the highest was 33 per cent in the Great Lakes area. The remainder of the geographical groups ranged between these two extremes, but there is not any significant geographical variation.

Years of Practice.—Here the low is 15 per cent and the high 31 per cent usage of myofunctional therapy, but, since the low of 15 per cent is in the 5- to 10-year group, and the high of 31 per cent is in the next older group (10 to 15 years), apparently the years of experience factor again does not bear any influence.

Question 7. In What Percentage of the Cases You Have Under Treatment Are You Using the Following Type of Technique?

The compilation of the data for this question has been set up in three different tables because of space requirements. Table III shows the detailed compilation of all replies. Table VI shows the breakdown by geographical components. Table IX shows the breakdown by years of practice of orthodontics.

Five technique types are shown in the question, namely, labiolingual, Johnson twin arch, edgewise arch, Universal appliance, and a fifth category entitled "Combinations of Above and Removable Appliances." It should be mentioned that in this last category are included the McCoy open tube appliance and various appliances of individual men's own construction.

Geographically.—The geographical location presents some rather distinct variation in the type of mechanical techniques used, as can be seen in Table VI.

The labiolingual technique finds its greatest popularity in the Middle Atlantic area, where it is used 35.8 per cent of the time. The Southwestern area used it 32.2 per cent; the Southern, 28.3 per cent; then there is a gradual decline to a low of 5.7 per cent in the Pacific Coast area.

The Johnson twin wire appliance, with the exception of the West Coast where it is used only 8.5 per cent, shows less marked fluctuation throughout the rest of the country. It is used mostly in the Southern Society area, with 43.4 per cent; in the Middle Atlantic next, with 37.8 per cent; then there is a gradual decline to 21.9 per cent in the Southwestern group.

The edgewise arch appliance is the most popular method, showing a usage of 56.5 per cent in the Pacific area; 52.3 per cent in the Great Lakes area; 47.5 per cent and 45.1 per cent in the Northeastern and Central Society areas; from which it declines to a low of 15.9 per cent in the Southern Society.

The situation in regard to the Universal appliance finds 21.2 per cent usage in the Pacific area and 18 per cent in the Rocky Mountain area, but there is a very low percentage in the other regions of the United States.

Combinations of the techniques, and removable appliances, are consistently used between 4 per cent and 9 per cent in all areas, with the exception of the Rocky Mountain area, where Table VI shows 19.2 per cent of use.

Years of Practice.—As can be seen in Table IX, these percentages reveal a rather interesting situation. Three of the five methods remain at an almost constant level of usage in all age groups. The Johnson appliance is used from 25 per cent to 27 per cent in all age groups, a variation of only 2 per cent. The use of Universal and combinations and removables ranges between 4 per cent and 10 per cent in all groups.

The interesting development arises in regard to the use of the labiolingual and edgewise appliances. The usage of these two methods varies in an inverse ratio, according to age groups. The use of the labiolingual increases from 12 per cent in the 1- to 5-year group to 32 per cent in the over-25-year group, an increase of 20 per cent in the older group. The reverse situation is shown regarding the use of the edgewise appliance, which declines from 47 per cent in the 1- to 5-year group to 25 per cent in the over-25-year group, a decrease of 22 per cent.

From the percentages derived from those answering the questionnaire, it is apparent that the edgewise appliance is used most. The Johnson is second in popularity and the labiolingual is third, with the exception of the men in practice over 25 years, who use the labiolingual somewhat more than the other two methods.

Question 8. Do You Have Equipment for Cephalometric Procedures?

Geographically.—There is some difference in the percentage of men who have equipment for cephalometric procedures in the various geographical areas. The high is 51 per cent in the Northeastern group, followed by Great Lakes, with 38 per cent, and the Middle Atlantic, with 36 per cent. There is a gradual decline to 14 per cent in the Rocky Mountain area.

Years of Practice.—As seen in Table VII, the percentages show a consistent trend, from 44 per cent of the men in the 1- to 5-year age group having equipment, to a low of 23 per cent in the over-25-year age group. However, although this is one of the few statistically consistent trends, the range of percentage is only 21 per cent, which is not as great as might be expected.

Question 9. If You Have Cephalometric Equipment, in What Percentage of Cases Do You Use It Routinely?

Geographically.—As can be seen in Table IV, there is a differential in the amount of use to which the cephalometric equipment is put in the various locations. The high is 85 per cent in the Central Section, and the low is 35 per cent in the Rocky Mountain area. The remaining six component areas range from 47 per cent in the Middle Atlantic to 72 per cent in the Pacific Coast Society.

Years of Practice.—In Table VII we find that there is not a great difference in the percentage of use of this equipment. Of the five age groups, the four younger ones show a range of use from 64 per cent to 79 per cent. In the over-25-year group, there is a considerable decline to 33 per cent.

Question 10. Do You Have Equipment for Photographic Procedures?

Geographically.—There is not enough range in the percentage of "yes" answers to this question to be of significance. The percentage is very high in all areas, varying from 80 per cent in the Rocky Mountain area to 96 per cent in the Northeastern and Great Lakes Societies.

Years of Practice.—The only differential displayed in the replies to this question is that 75 per cent of the men in practice over 25 years have photographic equipment, while in all the other age groups about 90 per cent have equipment.

Question 11. If You Have Photographic Equipment, in What Percentage of Cases Do You Use It Routinely?

Geographically.—Photographic equipment is used between 80 per cent and 90 per cent in all areas except the Rocky Mountain, where the percentage of usage is 65 per cent.

Years of Practice.—There is very little variation in the amount that photographic equipment is used. All age groups use it routinely in 80 to 90 per cent of their cases.

As previously mentioned, the remaining portion of this survey—that concerned with mixed dentition treatment—was the original thought that stimulated this article.

Questions 12 through 19 reflect some of the various considerations for mixed dentition treatment. To state the questions in an understandable manner, and yet keep them from becoming too complicated, presented a problem. The questions, as stated, represent an effort to stimulate replies which would reveal the practice procedures of the orthodontic group in the mixed dentition period.

In consideration of the table of replies, there is a point which should be emphasized lest there arise a misunderstanding. The percentages of "yes" answers indicate only that these men are treating some mixed dentition cases in that particular category. In other words, a man might be treating very few cases, or even only one, and yet he would reply with a "yes" answer. A 90 per cent in the "yes" column does not imply that this is the percentage of malocclusions being treated, but, rather, that 90 per cent of the men who answered are doing some work on this type of case. In many of the replies, the men who answered "yes" stipulated that they were treating only a small percentage of the mixed dentition cases which presented themselves.

An endeavor will be made to set forth the reasoning for the questions as they are discussed individually.

Question 12. Do You Treat Cases in the Mixed Dentition With Appliance Therapy?

This question is a generalized one which is broken down into more specific categories in the questions which follow. We later consider Class I and Class II treatment. No mention was made of Class III cases, since it was presumed that most men treat these patients as soon as practicable.

The problem of cross-bite cases and other simple situations did receive mention in some of the answers, but most of the men specified when they were treating only these cases, and this was considered in the tabulation.

Geographically.—Apparently there is no doubt about how the orthodontic group, as a whole, feels about some mixed dentition treatment. The "yes" answers to this question ranged from 92 per cent to 100 per cent, as can be seen in Table V, and, of course, there was no geographical variation to be considered.

Years of Practice.—In this category, as with the geographical, we find a very high percentage of "yes" answers. The percentage ranges from 94 per cent to 98 per cent in favor of some mixed dentition treatment, as seen in Table VIII.

Question 13. Do You Treat Class I Cases in Mixed Dentition With Appliance Therapy, Which Have as Their Only Defect Anterior Crowding of Less Than 4 mm.?

This question was expressed in that way to convey the impression of a reasonably normal occlusion which had some crowding of the anterior segments, the thought being that some men might feel that this type of case could be treated with hope of permanent benefit, since the deficiency was not too severe.

Geographically.—Table V reveals the range of "yes" answers to be from 11 per cent in the Great Lakes area and 14 per cent in the Rocky Mountain, Southwestern, and Northeastern area to a high of 50 per cent in the Middle Atlantic area. The other three groups fell midway between these extremes.

Apparently there is some difference in sentiment in various areas, regarding the treatment of this type of case, and yet there is no pattern, since adjacent groups do not approach the same percentage figures.

Years of Practice.—In Table VIII, we see that the percentages fall in much closer relation than those in the geographical breakdown. The highest percentage of "yes" answers is 27 per cent in the 1- to 5-year group and the lowest is 15 per cent in the over-25-year category. This, however, does not hold as a consistent tendency for the older groups to treat less, since a study of Table VIII will reveal that the 10- to 15- and 15- to 25-year groups treat some cases 25 per cent, as compared to 27 per cent in the youngest group.

Thus, we might conclude that, even though there may be a very slight tendency for years of experience to decrease the amount of mixed dentition treatment, it is not appreciable.

Apparently, my original thought—that years of experience in orthodontic practice might reflect a change in attitude on this problem—is not substantiated by the replies to this question.

Question 14. Do You Treat Class I Cases in Mixed Dentition With Appliance Therapy Which Have as Their Only Defect Anterior Crowding in Excess of 4 mm.?

The impression to be conveyed by this question was that of a more severe defect than was presented in the preceding question. It was thought that perhaps fewer men would treat these cases than the milder ones, since the defect was so pronounced that permanent benefit might be doubtful.

As revealed in Table V and VIII, such is not the case. In every geographical and age grouping, more men treat these cases than those with less crowding. There is but one exception, and that is in the Middle Atlantic area, where the percentage is greater for the less crowded cases.

Geographically.—The range of percentages here corresponds to the previous question, except that the percentages of "yes" answers are higher in all instances except one, as previously mentioned.

The Great Lakes area is lowest again, with 21 per cent of the men doing some treatment in these cases. Northeastern follows, with 24 per cent. Both of these groups show an increase of 10 per cent over the less crowded cases being treated. The Central and Pacific groups show a very slight increase; Central increased only 1 to 38 per cent; and the Pacific, 4 to 32 per cent of "yes" answers. The Southwestern showed an increase of 20 to 34 per cent, and both the Southern and Rocky Mountain groups showed an increase of approximately 30 per cent to 56 per cent and 43 per cent, respectively.

Years of Practice.—These percentages again are larger in every age group than in the previous question. The highest is the 1- to 5-year group, of whom 53 per cent treat some of these crowded Class I mixed dentition cases. In the 5- to 10-year group, 29 per cent treat some cases. The 10- to 15- and the 15- to 25-year groups show 39 per cent and 34 per cent "yes" answers, respectively. In the over-25-year group, we find 26 per cent of the men treating cases.

We find here a tendency for less treatment in the older age group, but I do not believe that is enough to draw any conclusion, since in both this question and the previous one the percentage of "yes" replies shows a decline only in the group with over 25 years of orthodontic practice.

The 53 per cent figure in question 14 (over 4 mm. crowding) in the 1- to 5-year group tends to magnify the trend out of proportion to the percentage shown by the other groups.

There are some conclusions that may be proposed from a study of the breakdown of questions 13 and 14. These are:

1. There is a slight tendency in the older age groups, to treat fewer Class I mixed dentition cases with appliances, but it is so slight, except in the oldest group, that it probably has no significance.

2. There is a definite increase in the number of men who treat the more severe Class I cases.

3. One fact that is very evident from these statistics is that, in all categories, the great majority of men are not treating any of these Class I cases in mixed dentition with appliances.

4. In Class I cases with less than 4 mm. of crowding, approximately 75 per cent of the men do not treat any. The 25 per cent who do treat some of them may be treating only a few.

5. The Class I cases with more than 4 mm. of crowding are not treated by approximately 65 per cent, and of the 35 per cent who do treat some, most are treating a limited number.

Question 15. Do You Treat Class II Cases in Mixed Dentition?

In the replies to this question, again it must be remembered that there is no qualification as to the number of Class II cases being treated by a man; a "yes" answer indicates merely that he treats some such cases.

Geographically.—There is some fluctuation in various areas concerning Class II treatment in mixed dentition. Except for the Southwestern and Rocky Mountain areas where 69 per cent and 71 per cent of the men, respectively, treat these cases, we find that in all the groups from 83 to 96 per cent are treating some Class II cases.

Years of Practice.—There is present in this category a slight variable in the percentage of men treating Class II cases, but the range of "yes" answers is only from 84 to 93 per cent, a 9 per cent fluctuation. While the 1- to 5-year group is highest, with 93 per cent, the range to the next highest, the over-25-year group, at 87 per cent, does not suggest that experience changes the outlook on Class II treatment in mixed dentition.

It is evident, from the replies to this qeustion, that there are many more men treating Class II cases in mixed dentition than Class I cases. Approximately 85 per cent of the men in all groups treat some Class II cases, whereas only about 35 per cent treat Class I cases.

Questions 16 and 17. In What Percentage of Class II Cases That You Treat Do You Use (16) Intermaxillary Elastics and in What Percentage Do You Use Headcap Treatment (17)?

The discussion of these two questions is being combined, since the percentages are in an inverse ratio in each case.

Incidentally, the total of the percentages of Class II elastics and headcap treatment will not equal 100 per cent, except by coincidence. In most instances, the answers given to these two questions did not approach a total of 100 per cent. Many of the men use bite plates and methods other than the two mentioned for treating Class II cases.

Geographically.—Five of the eight geographical areas use more Class II elastic treatment than headcaps, and the other three favored headcap treatment, as can be seen in Table V.

Years of Practice.—In Table VIII, it appears that there is a trend in the answers to these two questions as to age group and method used. In the use of Class II elastics, there is an increase from 36 per cent in the 5- to 10-year group to 69 per cent in the over-25-year group.

The opposite situation exists in the use of headcap treatment. The high is 56 per cent in the 5- to 10-year group, and there is a steady decline to 18 per cent in the over-25-year group.

The conclusion that may be reached from these questions is that the Class II intermaxillary elastic method of treating these cases is favored by men in the older groups and the headcap method is preferred by the group with fewer years of practice.

Question 18. Would You Treat More Mixed Dentition Cases if the Time Were Available?

The thought this question was intended to convey met with a bit of misunderstanding by some of the men who replied. It was presumed that most orthodontists were quite busy and probably overworked. However, if such were not the case and if the time for more work were available, would they treat more mixed dentition cases? By inference, the replies would indicate whether or not they felt that mixed dentition treatment was a worth-while undertaking.

As a result of the misunderstanding in this question, some very humorous replies were received, as well as some rather caustic comments.

Geographically.—The range of "yes" replies to this question was from a low of 21 per cent in the Rocky Mountain area to a high of 42 per cent in the Pacific Coast region.

A large majority of the men in all areas apparently do not care to treat any more mixed dentition cases than are now being treated.

Years of Practice.—The range of replies is very close in this question. The "yes" answers range from a low of 26 per cent in the 15- to 25-year group, to a high of 37 per cent in the over-25-year group. In the other three age groups

33, 34, and 35 per cent answered "yes." There is very little difference of opinion among the different age groups on this question of treating more mixed dentition cases.

Approximately 65 per cent of all men would not treat more mixed dentition cases.

Question 19. Do You Advocate Serial Extractions Where Crowding Is Excessive in the Mixed Dentition?

Geographically.—There is some difference of opinion, according to geographic location, with regard to the serial extraction procedure.

It is favored by a majority in all areas, but the Pacific Coast group is most enthusiastic of all and 87 per cent of them do advocate this procedure at times. The Northeastern, Great Lakes, and Central groups are next in line with 75, 74, and 73 per cent, respectively, suggesting serial extraction procedure.

The remaining four areas fall to 65, 64, and 61 per cent, with the Rocky Mountain group only 50 per cent in favor. Here we have another mixed dentition procedure which is acceptable to a majority of the orthodontists in all areas.

Years of Practice.—There is a marked difference of opinion, according to age groups, regarding serial extractions. In the 1- to 5-year age group, 90 per cent of the men advocate it, whereas in the over-25-year group, only 53 per cent have suggested it. The middle three age groups are in accord with each other, and their "yes" answers ranged from 70 to 77 per cent.

We find a definite decrease in the number of men in the older groups who advocate serial extractions. However, it is recommended by the majority in all groups.

SUMMARY

Regarding that part of the survey concerning what might be termed *office routine,* we have the following findings:

Question 3.—In the number of assistants employed, there is an increase with more years of practice, but there is no geographical variation. The number ranges from 1.36 to 1.84 assistants.

Question 4.—Some difference is found in the patient load by geographical areas, from a low in one area of 87 active patients to a high of 165 in another locality. In the age groups, it was found that the middle age group (10 to 15 years of practice) is caring for more patients than any other group, with an average of 148 patients per man.

Question 5.—Myofunctional therapy is used by approximately 70 per cent of orthodontists. No appreciable variation in either geographic or years of practice categories was found.

Question 6.—The percentage of cases in which myofunctional therapy is utilized, by the men who do use it, is about 25 per cent. The variations are slight, and apparently the number of years of experience does not bear any influence on the use of this adjunct to treatment.

Question 7.—Regarding the type of mechanical technique employed in practice, we find some distinct variations, both geographically and by years of practice.

In five of eight component societies, the edgewise appliance is the most popular technique. Next in popularity is the Johnson appliance, and the labiolingual is used extensively in three groups. The variations can best be visualized by consulting Table VI.

The variable usage by different age groups is found primarily in the amount of labiolingual and edgewise employed. The use of the labiolingual appliance increased from 12 per cent in the 1- to 5-year group to 32 per cent in the over-25-year group. The use of the edgewise appliance showed a reverse trend in that its usage increased from 25 per cent in the over-25-year group to 47 per cent in the 1- to 5-year group. The use of the Johnson appliance remains constant at 26 per cent in all age groups. For the Universal appliance and combinations and removables, usage ranges only from 4 to 10 per cent in all groups.

The conclusion from these data is that the edgewise appliance is used most, the Johnson appliance is second in popularity, and the labiolingual third, with the exception that the labiolingual is used slightly more than either of the other two methods by the men in practice over 25 years.

Question 8.—Cephalometric equipment is owned by a reasonably large percentage of orthodontists. Geographically, the high group has 51 per cent and the low group has 14 per cent, but the other six groups approximate 33 per cent quite consistently.

A greater percentage of the younger men have this equipment. There is a consistent trend for the possession of this equipment to be less in the older groups, but the decline is only to 23 per cent at the lowest from a high of 44 per cent.

Thus, we see that about one-third of the orthodontists do have cephalometric equipment.

Question 9.—The amount of use to which the cephalometric equipment is put does vary by geographic area from a low of 35 per cent of cases to a high of 85 per cent. The age factor does not influence the amount of usage, except in the oldest group. The four younger groups average about 75 per cent, but the over-25-year group uses it in only 33 per cent of cases.

Questions 10 and 11.—Photographic equipment is owned by almost 90 per cent of the orthodontists and it is used routinely in about 85 per cent of the cases.

The findings in the portion of the survey dealing with *mixed dentition procedures* follow:

Question 12.—We see that the great majority of orthodontists do some mixed dentition treatment. The answers reveal that 92 to 100 per cent approve of treating cases with appliances. There is no trend either geographically or by years of experience.

Question 13.—However, treatment of simple Class I crowding cases is not looked on with much favor, as we find that only 25 per cent of the men ever treat these cases with appliances.

Question 14.—When the crowding defect is specified as more pronounced, another 10 per cent consider treatment, but the increase is only to 35 per cent. There is a slight tendency in the older age groups, to treat fewer Class I mixed dentition cases, but it is so slight, except in the oldest group, that the significance is doubtful.

Question 15.—Treatment of Class II cases in mixed dentition is considered very favorably by all groups. Approximately 85 per cent of the men in all groups treat some Class II cases. No evidence is found that there is any difference of opinion on this question between age groups or geographical areas.

Questions 16 and 17.—Regarding the method of Class II treatment, Table V indicates that five of the eight geographical groups favor Class II elastic treatment and the other three prefer the headcap method. There is a definite trend for Class II elastic treatment to find favor among the older group, and the headcap method is preferred by the men with fewer years of practice.

Question 18.—Consideration of the question of treating more mixed dentition cases, if the men had time, shows that about 65 per cent of all the men would not treat any more. There is some geographical difference of opinion, as can be seen in Table V, but the factor of experience does not show any difference.

Question 19.—Serial extraction is a mixed dentition procedure which is acceptable to the majority of orthodontists. The geographical percentage variations of men who suggest this procedure are best seen in Table V. There is a definite trend for this practice to be less acceptable to orthodontists with more experience.

CONCLUSIONS

In the final analysis, we find that two mixed dentition procedures are favored by a majority of the orthodontists. These procedures are (1) treatment of Class II malocclusions and (2) the procedure of serial extraction.

Treatment of minor Class I cases meets with disfavor by the majority of the men. As the defect becomes more severe, the number of men who favor treatment increases but, even in these cases, the majority prefer not to use appliance therapy.

It seems that, basically, the orthodontic profession is in agreement on practically all the issues raised in this article. Some minor differences were uncovered, but not to the extent which was anticipated.

HOTEL JAMESTOWN BLDG.

AN ANALYSIS OF CHANGES IN THE DENTOFACIAL SKELETON FOLLOWING ORTHODONTIC TREATMENT

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IN THE past, several attempts have been made to study changes in the dentofacial skeleton following orthodontic treatment. The two main difficulties which must be overcome in the pursuit of this objective are: first, the procurement of suitable records of the rather minute changes which take place and, second, the separation of the changes which result from orthodontic treatment from those due to growth and development. This article deals with the presentation of a method which will be helpful for the study of changes induced by orthodontic mechanotherapy as contrasted with changes produced by growth and development.

A suitable record of a patient before and after treatment should provide the basis for a detailed study of the dentition proper, together with that of the structures around the teeth, and enable the investigator to establish some interrelationships between the two. Most previous attempts were doomed to failure for the simple reason that satisfactory records for such comparative study were not obtained. Studies utilizing facial casts,[1] dentofacial casts,[2] anthropometric measurements,[3] and oriented facial photographs[4, 5] can be mentioned as examples of such attempts.

When radiographs became available for recording projections of the facial skeleton and soft-tissue outlines, some of the needed requirements were at last fulfilled. It is not surprising, therefore, to find more conclusive evidence of the changes induced by orthodontic treatment after Pacini's[6] technique for the standardization of radiographs was perfected.[7, 8] The methods of analyzing radiographs for this purpose follow, in general, the procedures advocated for the utilization of cephalometric radiographs in orthodontic diagnosis. These methods can be divided into two main groups:

1. Metric studies of the linear and angular variations shown in lateral radiograms of the dentofacial skeleton, by Korkhaus,[9] Schwarz,[10] Margolis,[11] Björk,[12] and Downs.[13]

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2. Comparative studies of differences in proportions revealed by utilizing a mesh diagram based on a standard of reference, by De Coster.[14]

The first meaningful analyses of changes induced by orthodontic treatment were made by Brodie and his associates,[15] utilizing linear and angular measurements of cephalometric radiographs. The main conclusions of this study confirm the concept that "actual bone changes accompanying orthodontic management seem to be restricted to the alveolar process."

Inherent in the methods used by Brodie and his associates[15] and also those by Björk,[16] Downs,[17] Ballard and Walther,[18] Margolis,[19] and Steiner,[20] is a fundamental difficulty, namely, that of differentiating between the results of orthodontic treatment and the effects of growth factors. This limitation can be overcome, in part, by comparing segments of the dentofacial skeleton separately. For instance, a tracing of the mandible can be superimposed in a number of ways on the before- and after-treatment radiographs, each time using a different "base" line or point. By this procedure, an approximate idea can be obtained of the effects of growth on the size and the shape of the mandible and of the changes which, in all probability, were induced by orthodontic appliances.

In the present study, a different approach has been made to demonstrate how changes in the dentofacial skeleton following orthodontic treatment can be analyzed. By the use of the mesh diagram instead of linear dimensions, one has the advantage of being in a position to recognize many changes due to factors other than growth. This is generally true unless the growth changes have been more extensive for some parts of the dentofacial complex than for other parts, thus altering the proportional relationships between them. Allowing for these exceptions, the mesh diagram affords an excellent graphic depiction of the changes induced by orthodontic treatment.

The actual procedure can be summarized by stating that a mesh is drawn on tracings of cephalometric radiographs taken before and after treatment. The relationships of certain anatomic landmarks to the horizontal and vertical mesh lines in the before-treatment tracing are taken as a basis of reference. The relationships of the same landmarks to the mesh lines in the after-treatment tracing are then compared to those in the before-treatment tracing. The horizontal or vertical mesh lines in the follow-up tracing are changed, if necessary, in order to achieve a similar proportionate distance of landmarks to mesh lines as observed in the tracing made before treatment. The resulting distortions of the mesh lines call attention to differences in the position of landmarks within various rectangles of the diagram.

METHOD

A mesh is drawn on a tracing of a sagittal head radiograph following the method of Moorrees,[21] which is as follows:

A. Three lines are drawn from nasion (Fig. 1).—

1. The first line (S-N) connects the center of the sella turcica and nasion.

2. The second line (the anterior facial line) is at an angle of 85 degrees to the first line (S-N). It is drawn through nasion, ending approximately in the area below the chin.

3. The third line is a horizontal line drawn toward the occiput from nasion at right angles to the anterior facial line (line *2*) and equal in length to the distance S-N (line *1*). Line *3* is then divided into three equal parts and one part is added to an extension of the line at its occipital end.

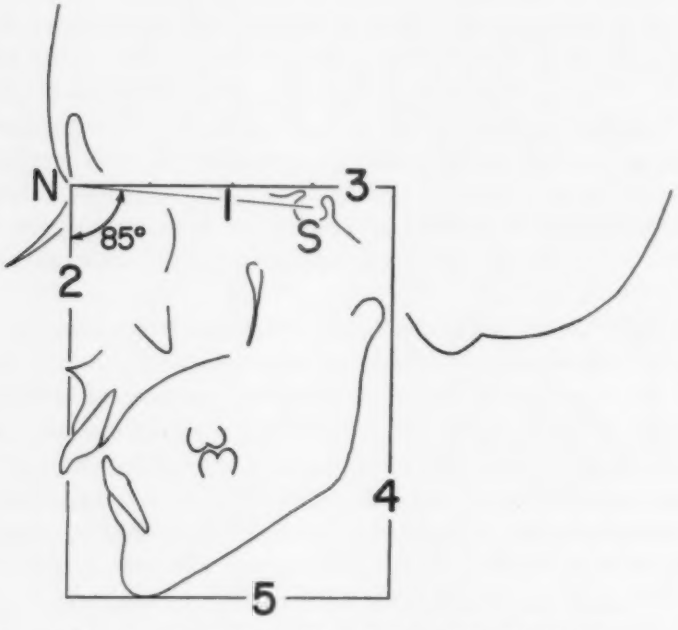

Fig. 1.—The construction of the mesh diagram.

B. A vertical line (*4*) is drawn through the posterior terminal point of line *3*, parallel to the anterior facial line (line *2*).

C. A second horizontal line (*5*) is drawn tangent to the lowest point of the bony chin and at right angles to the anterior facial line. This line completes the basic rectangle (Fig. 1).

D. The two vertical and horizontal lines of the basic rectangle are each divided into four equal parts. By connecting the dividing points, a craniofacial mesh results, consisting of sixteen rectangles.

E. A number of suitable anatomic landmarks and reference points are then carefully marked on each tracing. As a rule, sixteen such landmarks are employed.

The over-all dimensions of the facial structures may increase during the time which elapsed between the procurement of two radiographs of the skull.

In that case, the size of the rectangles of the mesh will be found to differ on the tracings made of the two radiographs. The proportionate relationship of the landmarks to each other and to the mesh lines will not be affected by this increase in size, however, unless the growth of one or more parts of the dentofacial skeleton has been disproportionate. It has been pointed out, for instance, that the growth of the mandible is to some degree independent of that of the maxilla and other bones of the face.[22] This has been observed also in crossbreeding of dogs by Stockard and Johnson.[23] Evidence has been presented by Schwarz[24] that the growth of the mandible and maxilla is not a fully correlated phenomenon during the prenatal period and shortly after birth. Björk,[12] in a cross-sectional study of Swedish males, furthermore demonstrated that the increase in prognathism is greater for the mandible than for the maxilla from 12 to 21 years of age. Later, Björk[25] was able to make a longitudinal study of the same boys and to compare the individual records for ages 12 and 20. This analysis revealed that individual growth increments vary "considerably in almost every detail" from the average growth changes determined by a cross-sectional study.

Since the present investigation also deals with the longitudinal records of four patients, one may expect to obtain some evidence of unequal degrees of growth in the mandible and maxilla. Inasmuch as the growth changes are graphically registered by utilizing this mesh technique, they can be more precisely defined. It is impossible, of course, to differentiate conclusively between the end result of natural growth and that of orthodontic treatment, especially if one happens to be dealing with a case in which growth actually accomplished the objective of the orthodontic treatment before the latter had effected any change in the tooth-bearing tissues.

In order to discuss in detail the application of the mesh technique for demonstrating changes following orthodontic treatment, a number of tracings have been selected for illustration. These tracings show how the osseous changes resulting from mechanotherapy are indicated by "distorted" mesh lines.

Fig. 2 shows a tracing of the cephalometric radiograph of a patient, 8.88 years of age, with very protrusive maxillary incisors before treatment. A more nearly normal anatomic incisor relationship and occlusion were obtained after 1.44 years of treatment, as shown in Fig. 3. In this case, the objective of the treatment was attained rather satisfactorily and quickly.

On each tracing a mesh was drawn, following the procedure previously outlined. The location of landmarks and reference points to mesh lines was carefully studied and any change in the relative positions of landmarks was indicated on the after-treatment tracing by redrawing the mesh lines.

The changes that occurred during the course of treatment of the patient were confined primarily to the premaxillary area and the mandible. The heavy lines in the premaxillary area indicate that the crowns of the maxillary incisors were tipped lingually and their roots labially. It can be safely assumed that the tipping of the maxillary incisors was a direct result of the

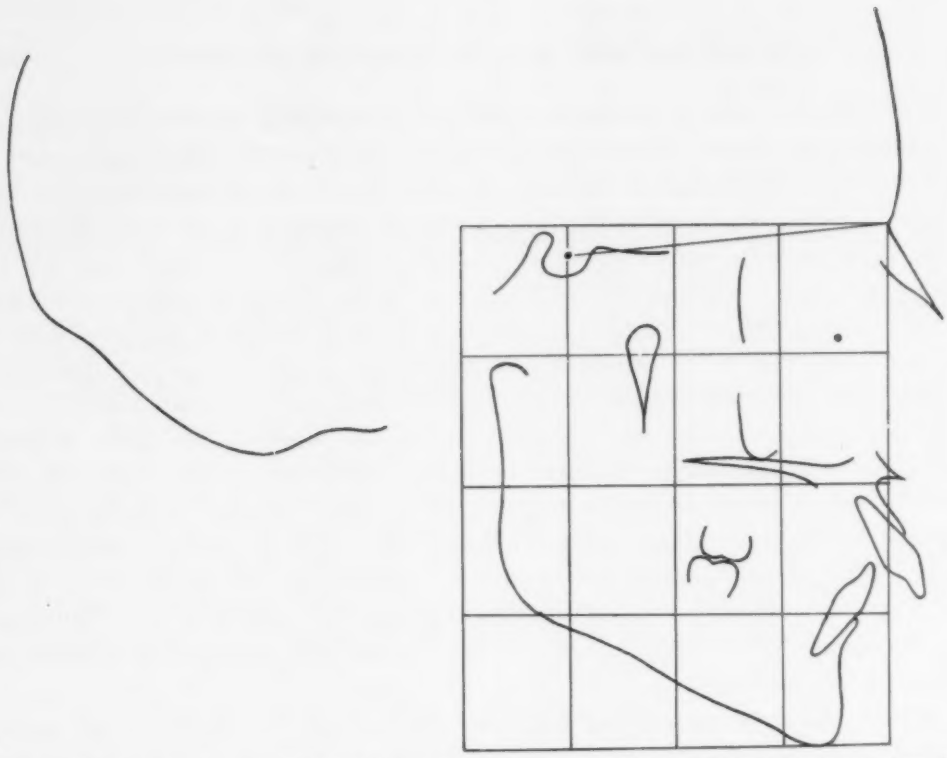

Fig. 2.—Tracing from a cephalometric radiograph of an 8.88-year-old girl with procumbent maxillary incisors.

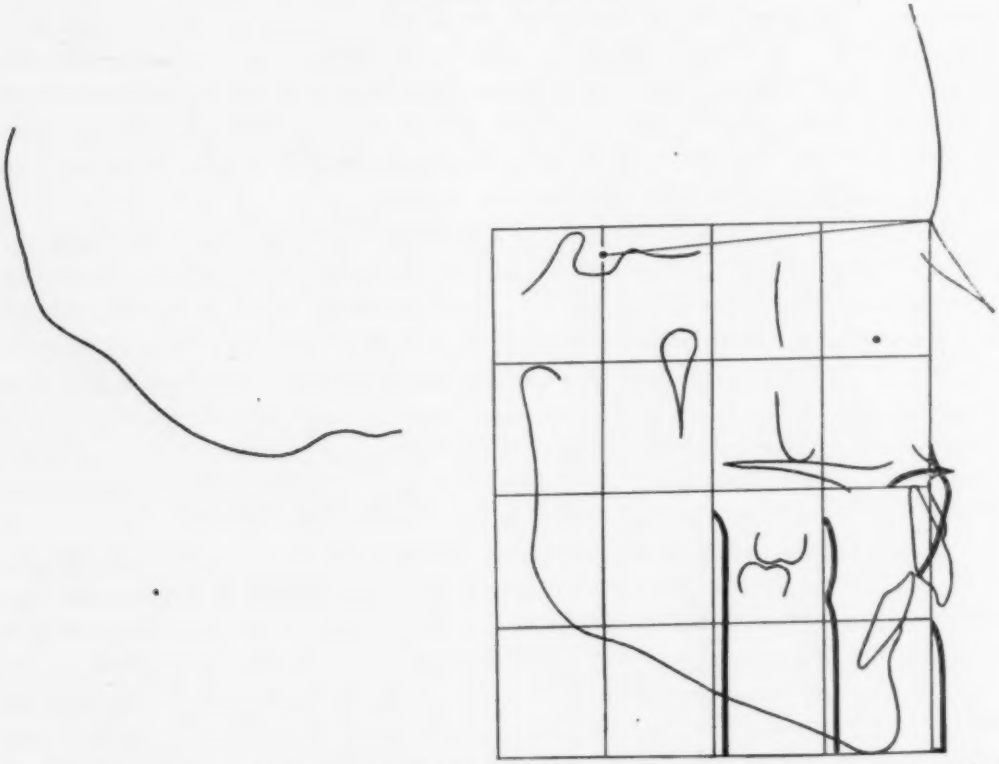

Fig. 3.—Tracing from a cephalometric radiograph of the patient shown in Fig. 2, after completion of 1.44 years of orthodontic treatment. At the time the radiograph was obtained, the patient was 10.32 years of age.

Heavy lines indicate differences in proportionate relationships of anatomic landmarks to horizontal and vertical mesh lines on the after-treatment tracing compared to the before-treatment tracing (Fig. 2).

orthodontic treatment, as the forces exerted by the appliances were aimed at this goal and there were spaces between the teeth which facilitated this movement.

The body of the mandible increased in length, as illustrated by the more ventral position of the chin, while the relative position of gonion has remained the same.

Comparison of the lengths and breadths of the basic rectangles on the original tracings, from which Figs. 2 and 3 were reproduced, disclosed that facial height increased 3.0 mm. during the course of treatment but that the breadths of the rectangles had not changed.

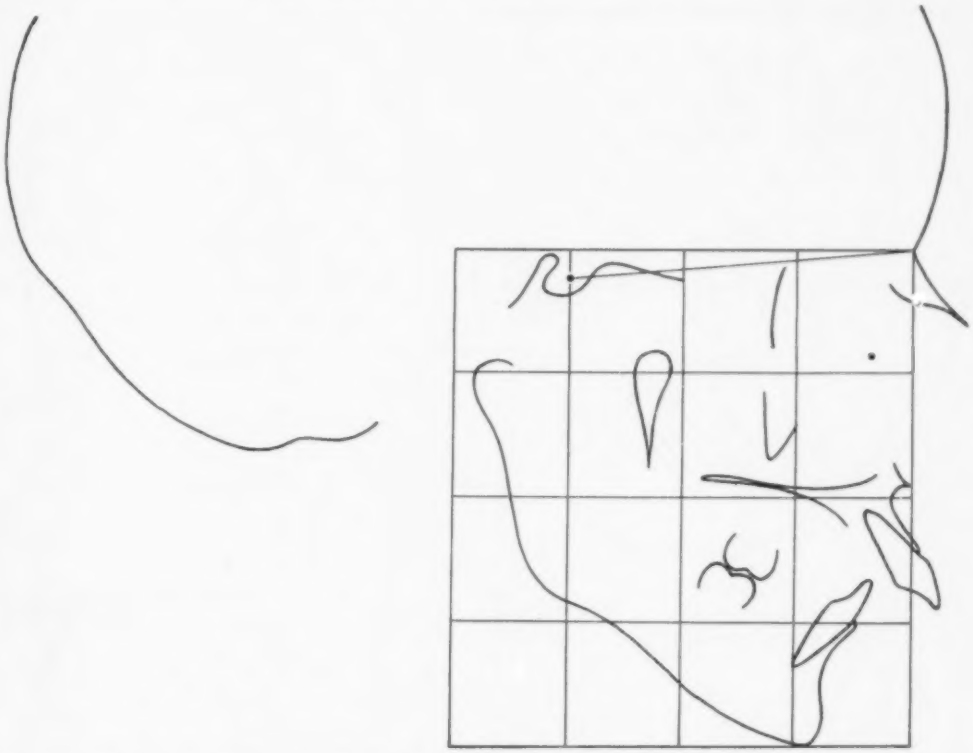

Fig. 4.—Tracing from a cephalometric radiograph of a girl 12.26 years of age, with procumbent maxillary incisors and slightly retrognathic mandible.

Following treatment, the first molars were in a more ventral position in their mesh rectangle. The anterior movement of the mandibular first molars can be explained by growth of the mandible. The maxillary first molars moved in conjunction with their mandibular antagonists, probably because of intercuspal contacts and because the deciduous maxillary second molars had been exfoliated just prior to the beginning of treatment, leaving a surplus of space after the eruption of the maxillary second premolars.

It also can be noticed that the mandibular incisors were slightly "uprighted" during the course of the treatment, resulting in a more nearly vertical angle between the axes of these teeth and a line tangent to the lower border of the mandibular body.

The tracing of a similar anomaly of the Class II, Division 1 type is shown in Fig. 4. Treatment was started when the patient was 12.26 years of age, and was completed in 0.84 year. The after-treatment radiograph, on which the analysis was based, was obtained 1.36 years after completion of treatment (Fig. 5).

Again, the maxillary incisors had been tipped lingually, with resultant forward adjustment of bone above and ventral to the apex of the tooth. In addition, the mechanotherapy had caused the mandible to come into a more ventral position, so as to bring about a change from disto- to neutroclusion of the molars. The height of the alveolar process of the mandible also increased in the region of the first molar.

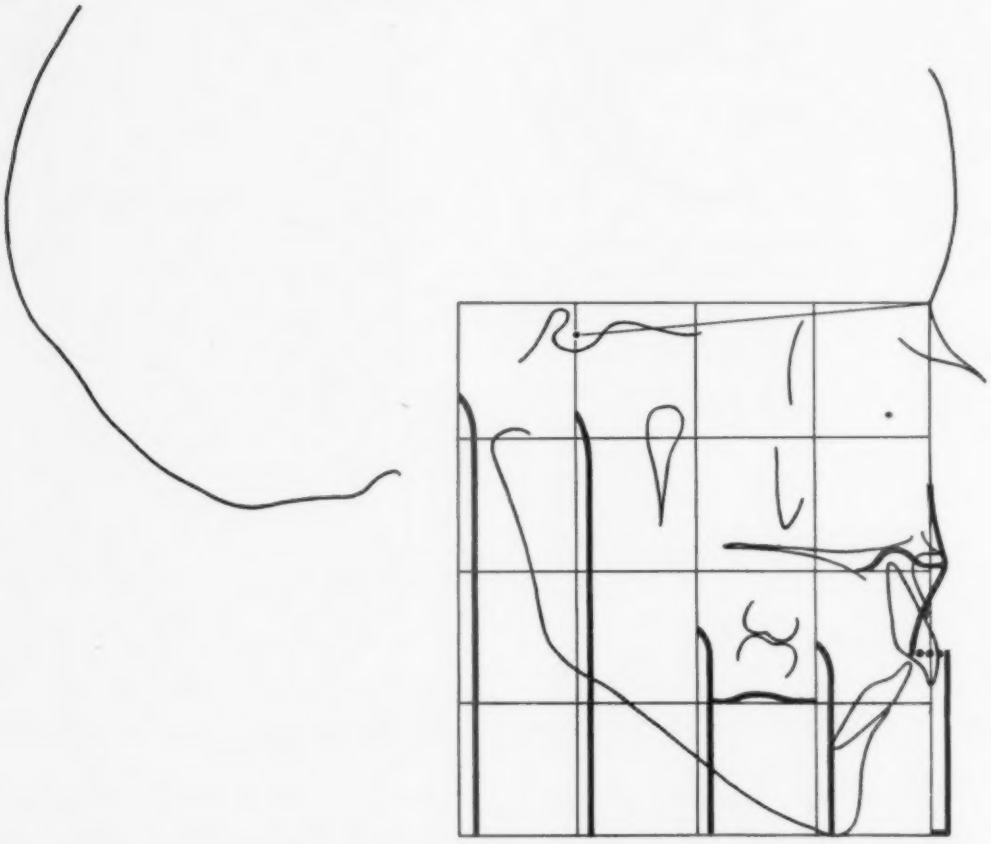

Fig. 5.—Tracing from a cephalometric radiograph of the patient shown in Fig. 4 after completion of orthodontic treatment, which required 0.84 year. This radiograph was obtained 1.36 years after completion of treatment, when the patient was 14.46 years of age.

Heavy lines indicate the changes due to growth and orthodontic treatment. (See also legend to Fig. 3.)

During the course of treatment, the maxillary dental arches were expanded and shortly afterward it was noted clinically that the mandible had assumed a more favorable position. Repositioning of the mandible, which was one of the objectives of treatment, was thus obtained indirectly, without the use of appliances attached to the mandibular teeth. This unexpected

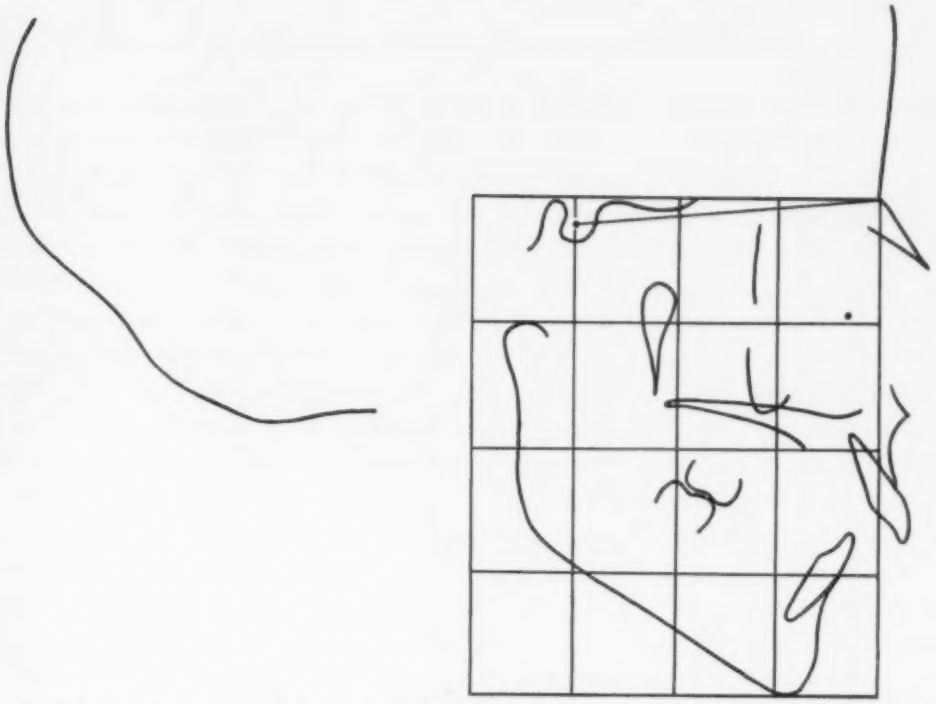

Fig. 6.—Tracing from a cephalometric radiograph of an 8.30-year-old girl with procumbent maxillary incisors.

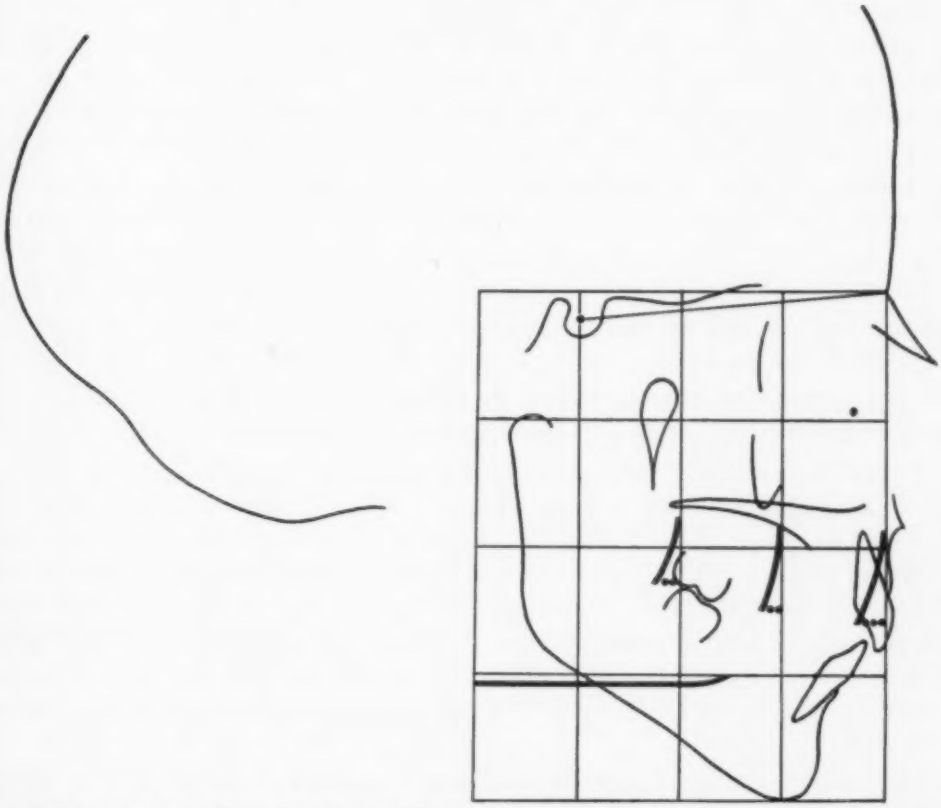

Fig. 7.—Tracing from a cephalometric radiograph of the patient shown in Fig. 6, after completion of orthodontic treatment. At the time the radiograph was obtained, the patient was 9.20 years of age. Duration of treatment was 0.90 year.

Heavy lines indicate the changes due to orthodontic treatment. (See also legend to Fig. 3.)

change in the relationship of the mandible to the maxilla greatly facilitated further corrective measures which consisted of forcing the maxillary incisors to assume a position more nearly perpendicular to the occlusal plane.

During the 2.20 years between the before- and after-treatment radiographs, an over-all growth of the facial skeleton occurred. The length of the basic rectangle was found to have increased 7.0 mm. and the breadth 2.5 mm. when the original tracings were compared with later ones. In contrast to the previous case discussed in this article, the growth increments of mandible and maxilla were not disproportionate. The distorted mesh lines in Fig. 5 indicate that the mandible as a whole assumed a new relationship to the maxilla and that the actual increase in dimensions is not appreciably greater for the mandible than for the maxilla.

The third instance of treatment analysis of a Class II, Division 1 type of occlusal anomaly is shown in Figs. 6 and 7. The distorted vertical mesh lines in the after-treatment tracing show lingual tipping of the maxillary incisors, together with distal movement of the molars in the same arch. It is of interest to note that a "head gear and removable labial arch" were used as a means of correcting the protruding maxillary incisors.

Treatment was commenced when the patient was 8.30 years of age and was completed within 0.90 year. During this short period an increase of 2.5 mm. occurred in facial height, measured as the difference in the lengths of the basic rectangles on the original tracings, from which Figs. 6 and 7 were reproduced. The relationships between the different landmarks were not changed appreciably by this growth, except that for the dorsal part of the body of the mandible, indicating that the ramus length increased proportionately slightly more than the facial height. No measurable change occurred in the breadths of the facial rectangles. It can be assumed that the distal movement of the maxillary molars and the lingual tipping of the maxillary incisors were induced by the orthodontic appliances. Epstein[26] likewise has been able to demonstrate that it is possible, in some instances at least, to move the permanent maxillary first molars in a distal direction with the use of a removable labial arch and occipitocervical anchorage.

A fourth example of treatment analysis, again of the Class II, Division 1 type of anomaly, is shown in Figs. 8 and 9. The correction of the "step" in the profile was accomplished with the aid of an Andresen[27] activator, worn only during the night for 1.69 years. Treatment was started when the patient was 4.58 years of age. The resultant changes illustrated by the distorted mesh lines indicate a slight lingual movement of the maxillary incisor crowns and labial movement of their roots in conjunction with a slightly more ventral position of the gonion and a distinctly more ventral position of the chin in relation to the maxilla.

During the course of treatment, growth changes occurred in the dentofacial area. Facial height increased 5.5 mm., since the lengths of the basic rectangles on the original tracings differed by this amount. The breadth of

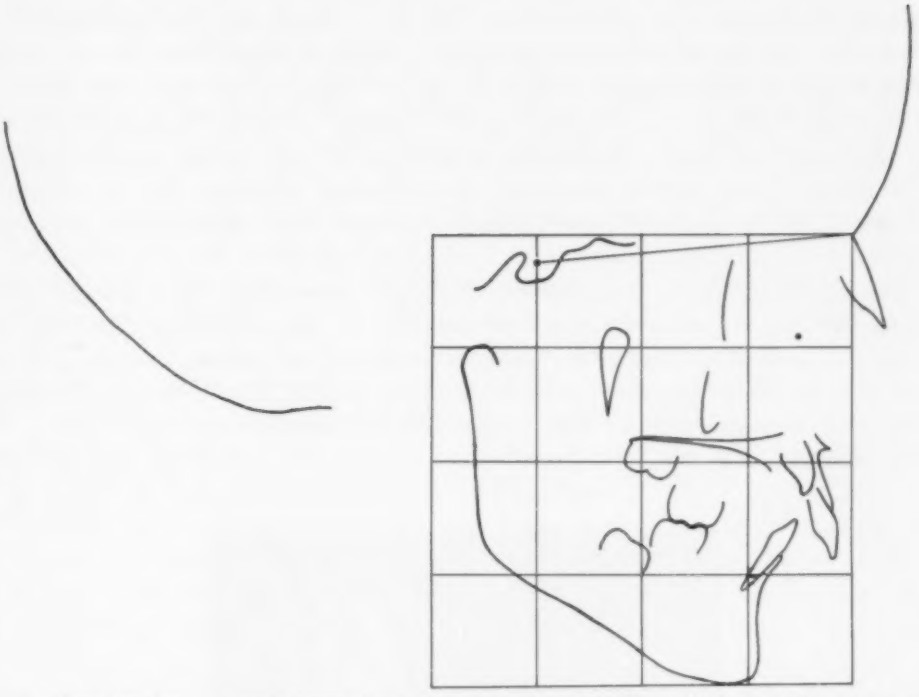

Fig. 8.—Tracing from a cephalometric radiograph of a 4.58-year-old boy with retrognathism of the mandible.

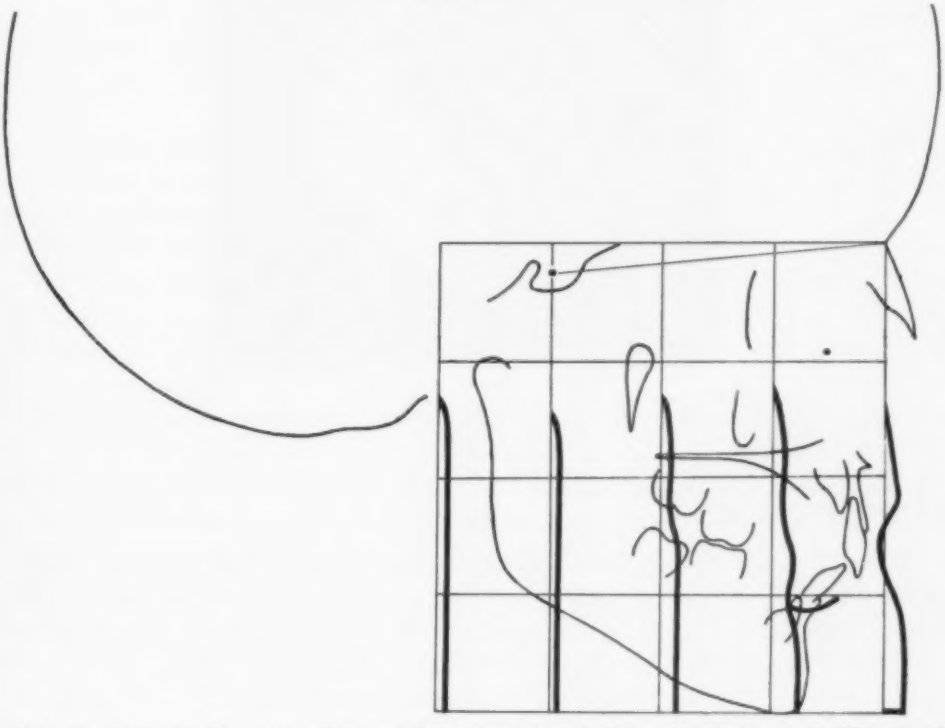

Fig. 9.—Tracing from a cephalometric radiograph of the patient shown in Fig. 8, after completion of orthodontic treatment which required 1.69 years. At the time the radiograph was obtained, the patient was 6.27 years of age.

Heavy lines indicate the changes due to growth and orthodontic treatment. (See also legend to Fig. 3.)

the facial rectangle was, furthermore, 2.5 mm. larger on the after-treatment tracing than on the original tracing. Yet, growth changes were greater in the mandible than in the maxilla, inasmuch as the body of the mandible increased markedly in length during the period of treatment. It can be noticed also that both the maxillary and mandibular deciduous second molars and permanent first molars erupted into a relatively more ventral position and that the relationship of the deciduous second molars changed from distoclusion to neutroclusion.

The change in molar relationship and the improvement in the boy's profile seem to be due not entirely to a repositioning of the mandible, but rather to the over-all growth of this bone. It can be argued, of course, that, without the use of the activator, similar changes in relationship would have taken place. Actually, it is impossible to determine, with the methods of analysis here presented, whether the success of orthodontic treatment can be fully credited to the activator.

Fig. 10.—The "activator" is essentially a bite block made of acrylic, not attached to the teeth, which guides the mandible with its dentition into a position of occlusal advantage. Thus, in the case of an anomaly of the Class II, Division 1 type, the mandible is moved forward (ventrally).

According to Andresen,[27] the wearing of the activator at night results eventually in a more favorable relationship between the dental arches and a subsequent change from distoclusion into neutroclusion.

Björk[16] and Softley,[28] utilizing radiographic evidence, also analyzed results obtained following treatment with activators. Björk reported that the changes were due, not to an alteration in the position of the mandible, but to a modification confined to the alveolar processes of the jaws. Softley stated that "the best clinical results were obtained in the cases which showed the greatest growth." These conclusions, together with the findings from the fourth example of treatment analysis just presented, provide some grounds for the inference that Nature can be the best orthodontist in certain instances.

From the examples given, it should be clear that application of the mesh diagram technique to the analysis of changes following orthodontic treatment facilitates interpretation in many ways. It makes possible a clearer differentiation between natural growth changes and changes induced by orthodontic treatment than is possible by the use of any other available method. This technique can be applied to a large body of data and it can be combined with other methods of analysis for more exhaustive scrutiny of the clinical material at hand.

Such information reveals that, frequently, treatment objectives are not reached through mechanotherapy, and thereby focuses attention on limitations of existing therapeutic measures in orthodontics. The analytic method can be used, furthermore, to study the changes which occur after orthodontic treatment has been completed and all appliances have been removed. It is known that the results of such treatment are not always of a permanent nature; relapses have been observed by many, if not all, practitioners who have observed their patients for a period of time following treatment.

Progress in orthodontics already has been attained by searching for possible causes of relapse. An example may be found in the treatment of occlusal anomalies of the Class II type, in which the occurrence of relapse has led a number of former disciples of Angle[29] to abandon his "never extract" dogma.[30]

Further studies of the changes during and after treatment may be expected, therefore, to lead to a sharper definition of possible treatment objectives and the achievement of greater stability of the end results of treatment. A more precise prognostic evaluation of patients will be one of the important fruits of such investigations.

SUMMARY AND CONCLUSIONS

1. Changes which occur in the dentofacial skeleton following orthodontic treatment have been studied by means of applying a mesh diagram method to the analysis of four individual clinical cases.

2. The advantages of the method are: (a) graphic depiction of changes, which facilitates interpretation; (b) elimination or reduction of analytic complications which arise from increases in the size of the facial skeleton during growth; and (c) suitability of the procedure for the study of disproportionate growth changes in parts of the facial skeleton.

3. The method presented appears worthy of application to larger bodies of suitable data and it may prove helpful for gaining a better understanding of the limitations of different methods of treatment in orthodontics. Such information will aid in the formulation of more realistic treatment objectives and, therefore, can be expected to lead to more efficient treatment planning.

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THE MESIAL DRIFT OF TEETH DURING GROWTH

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THE preparation for the practice of a specialty of dentistry includes a prerequisite knowledge of the basic sciences and the aquisition of all the available knowledge pertaining to that particular specialty. In the preparation for the practice of orthodontics, it is important to become familiar with the various concepts which are more or less accepted and which are depended upon, exclusively or in combination with other concepts, to explain or justify many standard procedures. Often we are not aware that some of these standard methods are contradictory, and it happens in many instances that the technical solution of an orthodontic problem is not consistent with its theoretical consideration.

All this is due to the fact that there are very few full-time research men in dentistry and even fewer in orthodontics. The greatest part of orthodontic research is carried on by faculty members of universities and graduate students in orthodontics; in most instances, this research is done in fulfillment of requirements for the completion of postgraduate courses. Usually these research men are engaged in private practice and they can give only a limited amount of time to systematic study. As a result, our knowledge is fragmentary and even the well-established facts are not properly correlated. It is inevitable, under such circumstances, that different concepts dominate in different quarters and, to a great extent, the investigations carried on by graduate students reflect these dominating concepts. Furthermore, we must realize that, beyond the prescribed thesis required to earn a certificate of proficiency, very few graduate students carry on independent research and, by consistently refusing other points of view, remain under the influence of the concepts originally given to them. The difficulty in this regard is brought on by the lack of coordination of the various points of view and by the acceptance of inconsistent concepts.

The distal movement of teeth for the correction of malocclusion falls into this category. The need for distal movement is explained by the mesial drift of the teeth through the alveolar bone. Any other reason that could be given would not be valid, for if the teeth did not move forward through the alveolar process there would be no need for distal movement during treatment. The procedure indicated, therefore, is consistent with the assumed existing conditions. The weakness of this reasoning is due to the tacit acceptance of the statement that the teeth may drift too far forward through the bone on one or both sides of a jaw; it is concluded without further inquiry that, inasmuch as this *may* happen, it *always will* happen. In the discussion of this problem,

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we must provisionally accept the fact that the teeth may drift too far forward through the bone, for if we are convinced that such forward drift cannot take place there can be no further discussion. It is possible, although not very likely, that evidence showing this is forthcoming, but until this is definitely proved we must provisionally accept the statement that it is possible for the teeth to drift too far forward through the alveolar processes. This statement, however, should be subjected to a rigid examination and several questions may be asked, each of which may demand a clear-cut answer. Granting, then, that such forward drift of the teeth may take place, it becomes important to know just how the forward drifting of the teeth occurs. Here, reference is made to the mechanics of the forward movement. It must be established whether this whole phenomenon is the overextension of the normal processes of growth or whether it takes place in a different manner. After these questions are answered, it still remains to be shown how the forward drift of the teeth may be recognized. This will involve a deeper understanding of the normal processes of growth and the relative size of the parts involved. There is increasingly more evidence to prove that during the transition from the deciduous to the permanent dentition the face has a more protrusive appearance, which does not disappear until after puberty. It is evident, therefore, that the degree of protrusion varies during the entire period of mixed dentition, so that care must be taken in the formulation of any rule that may be devised to aid in the recognition of the forward drift of the teeth.

In an attempt to better coordinate existing knowledge regarding the forward drift of teeth through the alveolar bone, it is convenient to begin with the studies of Brash.[1] He studied the problem of growth by the "indirect vital staining method which consists of feeding experimental animals with a coloring material, (madder) from the time of birth and then discontinuing for any period during which growth is to be observed. In this method the old bone is colored red, while the bone deposited during the non-madder period remains uncolored. Since any excess madder in the circulation is rapidly eliminated by the kidneys, the new white bone is marked off very sharply from the previously colored bone. In order to make the observations more reliable, on account of its large bones, the pig was selected as the experimental animal." The results of this experiment were reported in 1928 and, while they were accepted, the new information was not incorporated into the then existing knowledge. Today very little reference is made to this work, and the growth of the face of the growing child is studied in an entirely different manner. Yet, the fact established by the madder experiments cannot be overlooked. Since the accuracy of the work and the sincerity with which it was undertaken cannot be questioned, it must always form the basis of all future studies. Any other method of studying growth that gives results which are at variance with Brash's findings should be looked upon with suspicion and its accuracy questioned, even though it may appear to be very scientific, employing innumerable gadgets.

Brash established the incontrovertible fact that both the maxillae and the mandible grow by surface deposition and absorption of bone. He showed this very clearly in Figs. 1 and 2, which represent the outer and inner aspects of the left mandible of a 28-week-old pig subjected to indirect madder feeding.

Fig. 1.—The outer aspect of the left half of the mandible of a 28-week-old pig, the subject of madder feeding by the "indirect method." Madder was given in the food for fourteen weeks and then stopped for four weeks before the pig was killed. The shaded areas represent old bone colored by the madder, and the white areas the sites of deposit of new bone during the last four weeks' growth. (One-fourth reduction in size.) (From Brash: *Int. J. Orthodontia*, March, 1928.)

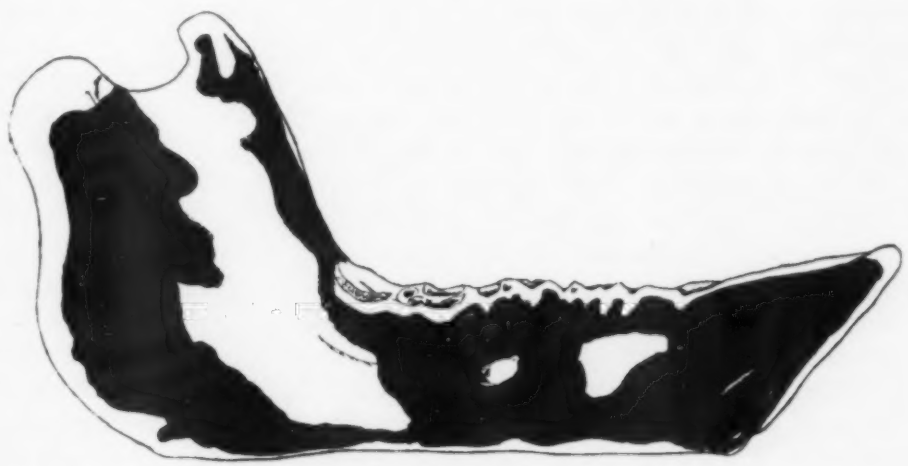

Fig. 2.—The inner aspect of the left half of the mandible shown in Fig. 1. (One-fourth reduction in size.) Note particularly the relation between the old shaded and the new white alveolar edges indicating the proximal movement of the teeth. (From Brash: *Int. J. Orthodontia*, March, 1928.)

The madder was given in the food for fourteen weeks and then stopped four weeks before the animal was sacrificed. The white areas represent new bone deposited during the madder-free period, while the shaded areas indicate old bone previously colored. Fig. 1 is the outer aspect of the mandible, showing that nearly the entire outer surface is covered with new white bone. The uncovered areas are shaded. The important point to note here is that the anterior

region and the entire ramus are covered with new white bone. The white areas shown in Fig. 2 indicate a heavy deposit of bone over the labial region and the symphysis, also on the posterior border of the ramus, but the anterior border of the ramus is conspicuously devoid of new deposit. The alveolar edge and the lower border of the body of the mandible show a considerable amount of new growth. The correlation of the areas of deposit on the inner and outer surfaces reveals that, while the mandible grows by heavy deposits of bone on the posterior border of the ramus, it also grows by a nearly equal amount of deposit on the labial or anterior areas. This is not consistent with the teachings of Hunter[2, 3] and Hellman,[3] who maintained that, once the anterior part of the dentition is formed, it does not change. This disagreement may be resolved by discarding Hunter's and Hellman's explanations, and by coordinating Brash's findings with other known facts. A further proof of the correctness of these conclusions is found in Figs. 3 and 4, in which the lingual and buccal sides of the sagittal section of the right half of another pig's mandible are shown. These sagittal sections disclose the most valuable information regarding the growth of the mandible, and they show for the first time that, as the jaw enlarges, changes in the positions of both the erupted and unerupted teeth take place. The lingual side of the sagittal section (Fig. 3) shows that there is a deposit of new bone throughout the entire depth of the tooth sockets and crypts containing tooth germs of unerupted teeth and also a considerable deposit on the distal wall and gingival portion of the socket of each fully erupted tooth. It is particularly important to note that the lingual walls of the anterior tooth sockets are completely covered with new white bone. The buccal side of the sagittal section (Fig. 4) presents an entirely different picture. Here the sockets are not covered with new bone and there is evidence that the old red bone still lines the lower end of the tooth sockets. The layer of white bone on the gingival edge of the sockets confirms the observation that the teeth move occlusally and the occlusal level is slowly raised. The white bone on the lingual wall of each tooth socket and the red bone on the buccal walls indicate that the teeth move buccally during growth. A deposit of white bone on the distal wall of the tooth socket and on the occlusal edge indicate that, in addition to buccal movement, all teeth move forward and occlusally through the bone. This is a definite proof that Hunter and Hellman were mistaken in their view that the anterior part of the dental arch remains unchanged after it is fully formed. It should be noted, at this time, that the movement of the teeth through the bone is consistent with the belief that it is possible for the teeth to drift too far forward within the jaws. There is nothing in the work of Brash that would discredit this belief, and if extensive forward drift does actually take place in some instances, it represents an overextension of the normal processes of growth. It must be admitted, then, that it is possible for the teeth to drift too far forward.

The admission of this possibility, however, does not enable us to recognize the excessive forward drift of the teeth every time it occurs. In order to be able to select those cases in which excessive forward drift of the teeth has taken

Fig. 3.—The lingual side of a "sagittal" section of the right half of the mandible of a 26-week-old pig, the subject of madder feeding by the "indirect method." Madder was given in the food for nine weeks and then stopped for three weeks before the pig was killed. The shaded areas represent old bone colored by the madder, and the white areas the sites of deposit of new bone during the last three weeks' growth. (One-fourth reduction in size.) (From Brash: *Int. J. Orthodontia*, March, 1928.)

4.—The buccal side of the "sagittal' section of the right half of a mandible (One-fourth reduction in size). Same mandible as in Fig. 3. Attention is particularly directed to the distribution of the new bone in the alveoli, as described in the text. The differences between the lingual and buccal sides and the proximal and distal walls in Figs. 3 and 4 indicate movements of the teeth in the buccal and proximal directions. The backward growth of the large alveolus of the permanent canine in the mandibular canal is also demonstrated. (The disproportionate size of the incisor regions in Figs. 3 and 4 is due to the fact that these regions were drawn separately and fitted onto the rest of the drawings so as to give a complete view of the lingual and buccal sides of all the alveoli with consequent loss of perspective.) (From Brash: *Int. J. Orthodontia*, March, 1928.)

place, we must be able to define, or at least describe, what constitutes excessive forward drift. The very use of the word *excessive* suggests a quantitative interpretation, for *excessive* means "more, or going beyond proper limits." But what are the proper limits? How much beyond these limits is considered excessive, and how are we to measure this excess? It is most difficult to find an answer to these questions, but the following considerations may throw a light on this perplexing problem.

Since we know that the teeth move forward through the bone during growth, a certain amount of this forward movement must be looked upon as normal. While we cannot actually measure the normal forward growth, we may form an approximate idea of the distance the teeth must move forward.

Fig. 5.

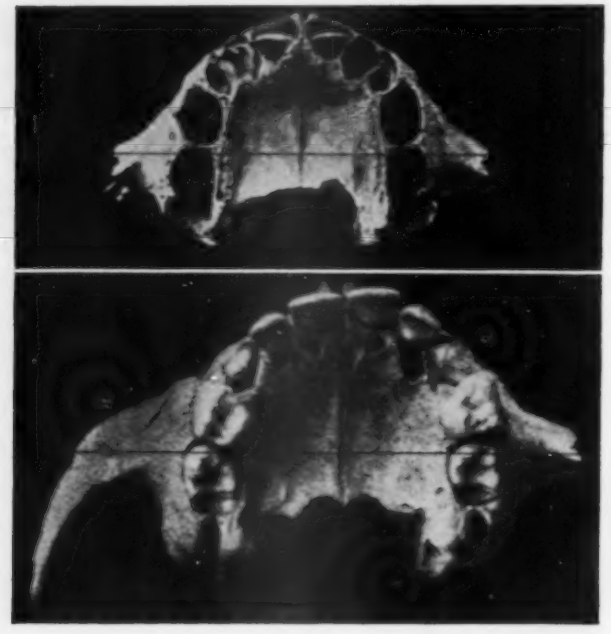

Fig. 6.

Figs. 5 and 6.—(From Wallace: Variations in the Form of the Jaws, William Wood & Company, publisher.)

In this connection, it is interesting to read J. Sim Wallace's[2] description of the growth of the maxillae. After describing the growth of the mandible, he says: "Turning now to the maxilla, we find almost parallel changes, but the surface depositions are somewhat complicated by growth at the median and palatal sutures. Nevertheless it is brought about by the same forces, and a similar surface absorption and deposition of bone takes place. The general moulding and backward translation (in relation to the teeth) of the malar process and zygomatic arch were clearly brought out by O. Zsigmondy in 1911. The line through the malar process in the six different year periods indicated (Figs. 5 to 10) shows a very distinct change in relation to the teeth." It is important to note that, in conformity with Hunter's teachings, Wallace regards the

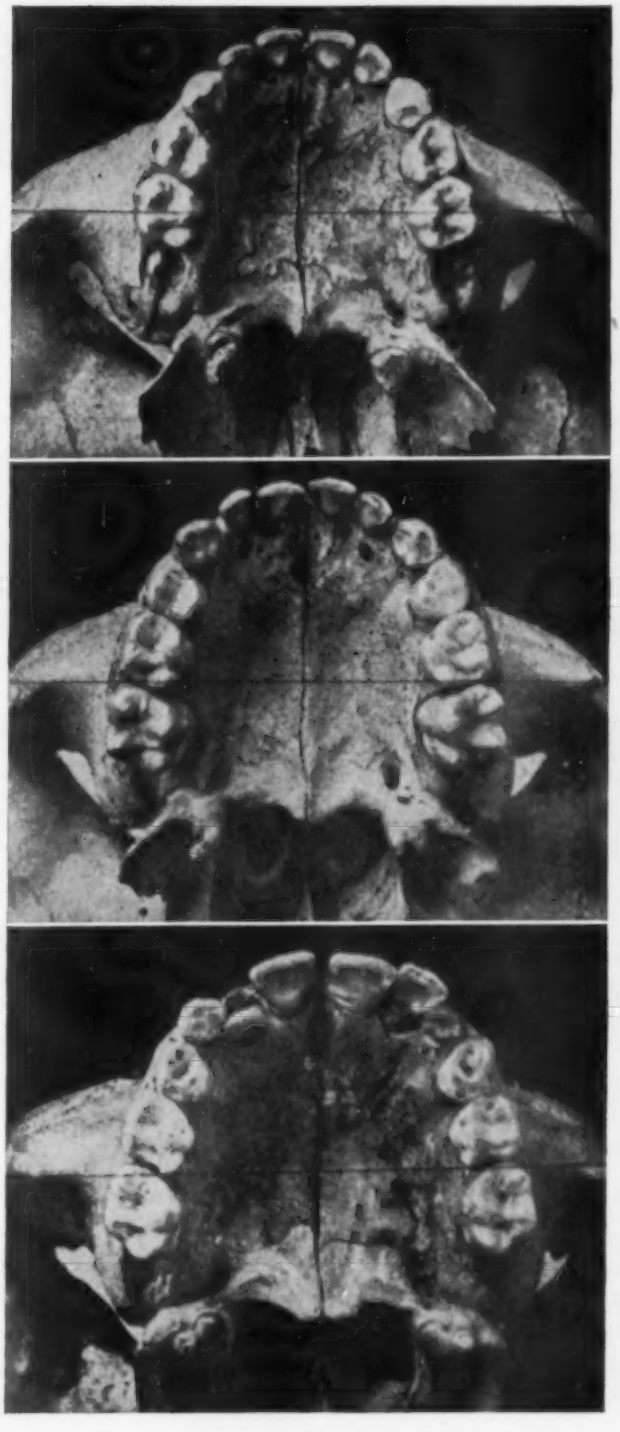

Fig. 7.

Fig. 8.

Fig. 9.

Figs. 7, 8, and 9.—(From Wallace: Variations in the Form of the Jaws, William Wood & Company, publisher.)

anterior portion of the dental arch as static and refers to the backward translation of the malar processes. But at the same time he adds that this backward translation is in relation to the teeth, to dispel the impression that the maxilla grows backward. A careful study of these illustrations will reveal that the maxilla grows forward, together with the malar processes. Fig. 5 depicts the maxillae of an infant in which the deciduous teeth have not yet erupted. The malar processes are small and the line drawn through them passes behind the crypts of the deciduous first molars. Fig. 6 shows the maxillae of an older child. Here, the deciduous dentition is completed and the permanent anterior teeth are just beginning to erupt. The malar processes are larger than in the previous illustrations, and the line drawn through them may be somewhat

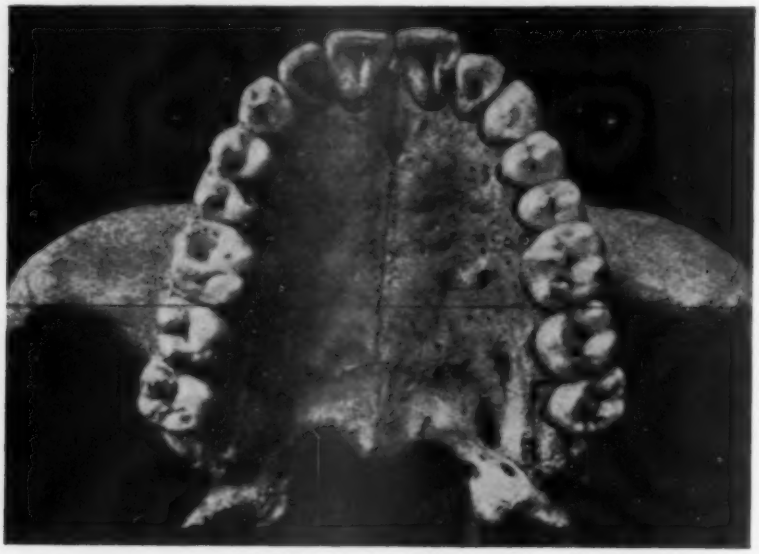

Fig. 10.—(From Wallace: Variations in the Form of the Jaws, William Wood & Company, publisher.)

further behind the deciduous first molars. The child in Fig. 5 may have been 8 or 9 months old, but certainly not more than 12 months, while the child whose maxillae are shown in Fig. 6 must have reached at least its fifth year of life. Since these are bones of different subjects, the only comparison we can make is that the malar processes of a 5-year-old child are larger than those of a 1-year-old child. Fig. 7 shows the maxillae of a still older child, indicating that the malar processes are much better developed, space is provided for the permanent first molars, and the malar line now passes through the middle of the deciduous second molar teeth. Unquestionably, the relationship of the dentition to the malar processes has changed and the maxillae are much further forward than at an earlier age. Fig. 8 illustrates the case of a child which must have been 6 or 7 years old. The permanent first molars had already erupted and the malar processes are much better developed and are larger. The malar lines pass

through the contact points between the permanent first molars and the deciduous second molars, so that the entire dentition is in a more forward position in relation to the malar processes.

The case shown in Fig. 9 is that of a child somewhat older than the one shown in Fig. 8. The permanent incisors are already in position, the malar processes are larger, and the spaces for the permanent second molars is beginning to form. The malar line now encroaches upon the permanent first molars.

A completed adult dentition, with much larger malar processes, is shown in Fig. 10. The malar line passes behind the permanent first molars. The lesson to be learned from these illustrations is that the malar processes grow and become larger during growth and development and that the entire dentition moves forward in relation to the malar processes, an amount equal to the combined mesiodistal widths of the permanent first molar and the second premolar. But this represents only a relative change. Attention was called to the fact that the

Fig. 11.—(From Angle: Malocclusion of the Teeth, ed. 7, S. S. White Dental Mfg. Co., publisher.)

malar processes became larger in each successive older subject, which means that the malar processes also move forward. It is evident, therefore, that the total forward displacement of the dentition is the sum of the forward growth of the malar processes and the change in the relationship of the dentition to the malar bones. This is shown more clearly in Fig. 11, where lines are drawn on an illustration taken from Angle's seventh edition of *Malocclusion of the Teeth*. The line *O-O* represents the approximate position of the occlusal plane, while the lines *C, P,* and *D* are perpendicular to the plane of occlusion through the head of the mandibular condyle, the contact point between the first and second permanent molars and the contact point between the first and second premolars, respectively. The study of this illustration reveals important relationships to us.

Here we find a most remarkable confirmation of Zsigmondy's observation that the line drawn through the right and left malar processes of an adult skull passes through the contact point between the permanent first and second molars. The photographic films in Zsigmondy's illustrations were kept parallel to the occlusal surfaces. The line *P* in Fig. 11 is drawn perpendicular to the line *O-O*, which represents the approximate position of the plane of occlusion, and it passes through the point on the malar process selected by Zsigmondy. The difference between the positions of lines *P* and *D* is the change in the relationship of the dentition to the malar line during the growth and development of the individual from infancy to adulthood; for, if we remember, in the infant skull the malar line passed through the contact point between the first and second deciduous molars, which is roughly represented in Fig. 11 by the contact point between the premolar teeth. Since we know the average mesiodistal diameters of the first permanent molar and the second premolar, we may safely say that, in round numbers, the dentition moves forward through the bone a distance of 20 mm. during the transition from infancy to adulthood. But young adulthood is reached in the sixteenth or eighteenth year of life, so the transition from infancy takes about fourteen to sixteen years. Thus, the average forward positioning of the dentition in relation to the malar processes is slightly more than 1 mm. per year. We must recognize a condition, however, which may indicate that the forward positioning of the anterior part of the dental arches takes place at a greater rate during the early years of life. It is a well-established fact that the deciduous first and second molars are wider mesiodistally than the first and second premolars. It is very likely, therefore, that the anterior section of the dental arch is pushed forward through the bone much more rapidly in the early years of life. When the deciduous teeth are lost, the difference in mesiodistal diameters is taken up by a more rapid forward movement of the permanent first molar. Thus, it appears that the anterior teeth may be further forward in position earlier in life than the posterior teeth, and this may account for the more protrusive appearance of the adolescent and, to some extent, the preadolescent child. This is a most important observation, because, not realizing that the protrusion of adolescence is a normal state, the distal movement of the teeth is frequently recommended. If we further consider that the distal movement of the teeth, even by the most efficient methods, seldom exceeds a few millimeters, then we have sufficient proof that the distal movement of the teeth is not desirable and therefore not necessary. The protrusion of the dentition in the early years of life is not a proof that the teeth are too far forward in relation to the face. The protrusion represents merely a transitional condition which must be regarded as normal. Were this not a normal condition, then this entire change would have to be looked upon as an overextension of the normal processes of growth, which does not occur in any other part of the skeleton. It would seem that if the forward displacement of the dentition reached the position represented by line *P* at a very early age, it would still have to be regarded as normal, for, having reached that position, we cannot be sure that further forward positioning would take place in the years that follow. It may be asked whether the mandible is also protruded when the maxillary teeth are pushed forward

through the bone. We know that the mandibular teeth also move forward through the alveolar processes and that the mandible grows by surface deposits and absorptions. Brash furnished sufficient proof of the correctness of this, and the question arises as to how the malrelation of the arches may develop. From Zsigmondy's presentation, it was well established that the malar processes grow larger during the transition from infancy to adulthood; therefore, the distance between lines *C* and *P* must become larger during this change. Inasmuch as a portion of the mandible is also included between lines *P* and *C*, we may conclude that the included portion of the mandible also becomes larger during this period. The work of Brash confirms this conclusion and now we may inquire whether the mandible always keeps pace in its growth with the malar processes and the maxillae. From the very large number of Class II cases, it follows that this does not always take place and the portion of the mandible included between lines *C* and *P* fails to develop to the fullest extent in those instances. It is expected that differences of opinions will arise regarding this point. It may be argued that, since the maxillary teeth are too far forward, they must be moved distally to meet the mandibular teeth and, besides, the contention is, that it is not possible to reposition the mandible permanently. There are two important errors in these arguments. First of all, it is not possible to determine whether the maxillary teeth are too far forward in relation to the malar processes or whether they are in a temporary forward position. Second, it is not taken into account that the portion of the mandible included between the lines *C* and *P* has the power to accommodate itself to changing conditions. This is readily seen in Fig. 12, where the mandible is shown at different periods of life. It is shown that the gonial angle changes during life to accommodate the mandible to changing conditions in the dentition. The concept of the fixed centric relation we have acquired from the prosthodontists, who have an entirely different problem. They endeavor to construct prosthetic appliances to the usual and most comfortable position of the mandible, while the orthodontist's problem is to change the positions of the teeth and the position of the mandible to establish normal occlusion. These are entirely different problems. In the development of the face of a child, many complex processes go on at the same time. In both the maxillae and the mandible, the deciduous teeth are shed and, concurrently, the permanent teeth seek their normal positions. Usually the successively occurring events are well timed and normal relationship between the various dental units and the jaws is established. It is always expected that the maxillary and mandibular first molars lock properly and thus the normal relationship is maintained. Under the influence of function and normal functional relationship, the mandible is forced to keep pace with the growing zygomatic arch, malar bone, and maxillae, and the normal relationship is maintained. But it frequently happens that the maxillary and mandibular permanent first molars do not lock properly. If the mandibular molars are distal to the maxillary molars, Class II cases develop, while in those few cases in which the mandibular molars are mesial to the maxillary molars, a Class III case develops. Under all these circumstances, the mandible adapts itself in such a way that the normal occlusion or the particular malocclusion becomes the most comfortable position for

the patient. This implies an ability on the part of the mandible to adapt itself to changing conditions. We know that the shape of the mandible changes during life (Fig. 12). Therefore, we can accept the explanation just given without further proof. This explanation is in agreement with Brash's

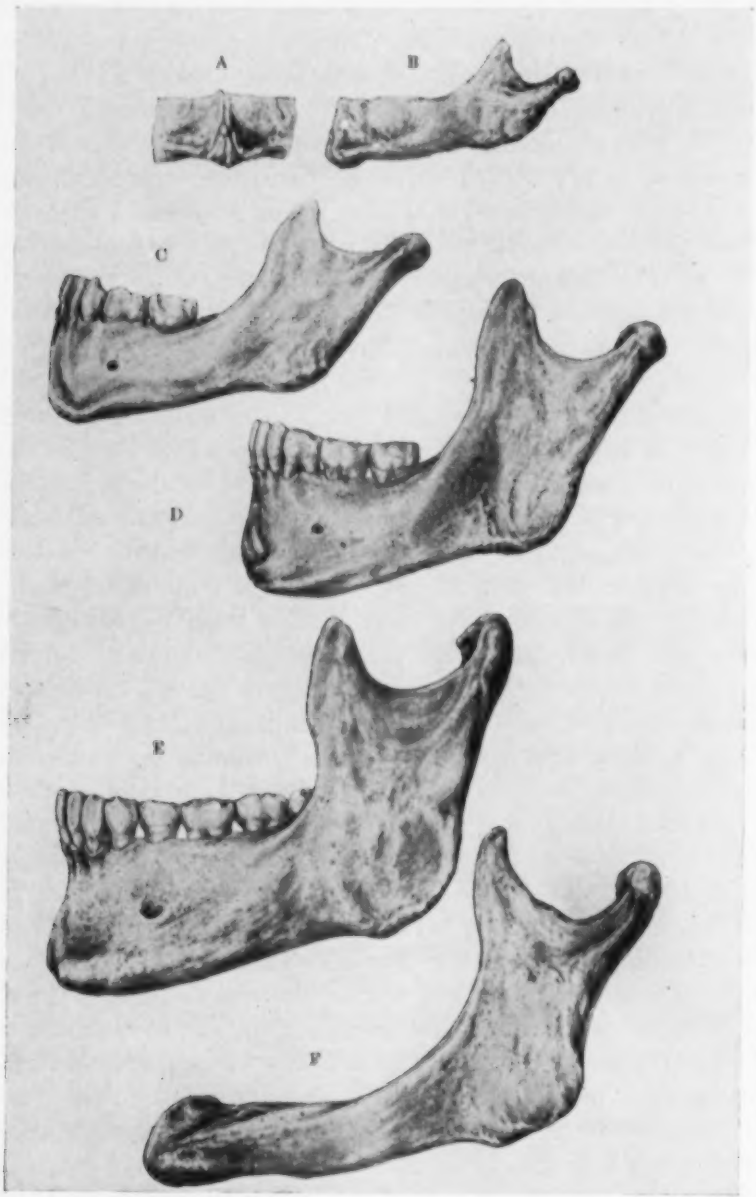

Fig. 12.—The mandible at different periods of life. *A*, At birth. Anterior aspect, showing the ossicula mentalia. *B*, At birth. Left lateral aspect. *C*, At 4 years. Full deciduous dentition. *D*, At 8 years. The permanent incisor and first molar teeth have erupted; the deciduous molars are in the process of being shed. *E*, Adult. *F*, Old age.

description of the growth of the mandible, and there is nothing in the known processes of growth which would contradict this concept. The development of the dentition is a very complex process, and the establishment of normal conditions depends to a great extent on the accurate timing of the several events.

In case of inaccurate timing, the normal relationship of the teeth is not always established and, as a result, the position of the mandible is changed. It is very fortunate that there is an adequate compensating mechanism to alter the dimensions of the mandible to meet the requirements which at times may be very severe. Thus, we must look upon the portion of the mandible included between lines *C* and *P* as the part containing the compensating mechanism without which the changes in occlusion could not be tolerated. Nature provided a compensating mechanism which aids us in the establishment of normal occlusion by orthodontic means. We have repositioned the mandible very many times in the past, notwithstanding statements to the contrary.

This better coordinated concept of growth changes opens up new fields for investigation. While it is certain that the conclusions drawn from the known facts approximate the truth, nevertheless, the possibility still remains that the conclusions arrived at are not correct in every respect. The work of Brash is so important that it should be repeated several times by different investigators on different animals higher on the tree of evolution. This is necessary in order that we may state with certainty that the mechanism of the enlargement of the face is the same for all animals, including man. If this can be shown to be a fundamental biologic process, then the difference in the form of the various species may be explained by the difference in the relative rates of growth. It will become clear at once that differences in form can be explained only on the basis of relative rates of growth in the various directions, and this explanation applies equally to the different species and variations within the same species. Furthermore, if the mode of enlargement of the face can be shown to be the same for all species, it would strongly support the theory of evolution.

It must be considered, however, that repeated studies may disclose that the mode of enlargement of man's face differs from that of the pig, which was the experimental animal used by Brash. In that event, the particular mode of enlargement specific for man should be independently studied.

It is of very great interest to us to know more about the facts observed by Zsigmondy. We have seen that the entire dentition moves forward in relation to the malar process, a distance of about 20 mm. from infancy to early adulthood. It is not known, however, whether or not this change takes place uniformly. Indications are that the rate of forward displacement is greater during the preadolescent period and diminishes during adolescence. When young adulthood is reached, the forward growth continues at a much slower rate throughout the life of the individual.

The growth of the malar bones and the right and left zygomatic arches add to the forward displacement of the face in relation to the head, and we should make every effort to learn everything possible regarding this forward change. From our limited knowledge, the malar bones appear to grow forward less rapidly than the alveolar arches but in later life this growth continues at a greater rate. Thus, according to our best understanding, the alveolar processes, together with the teeth, move forward very rapidly in the early

years of life, and only minor changes take place after young adulthood is reached. The malar bones lag behind. It is almost certain that this difference in forward growth gives rise to the more protrusive appearance of all adolescents which, in the light of our present knowledge, is looked upon with increasing alarm. There is an increasing tendency to reduce this protrusion of adolescence by extracting four premolar teeth. For this reason, it is most important that we investigate the mechanism of growth more thoroughly and study the forward growth of the jaws in relation to the forward growth of the malar bones. Because of the permanent injury which may be inflicted on large numbers of children, this problem must take precedence over any other problem, except perhaps the repositioning of the mandible. There is a controversy regarding the possibility of changing the normal position of the mandible. It is maintained by some that, regardless of what we may do, the position of the mandible in relation to the maxillae cannot be changed by orthodontic means. It is reasoned that, inasmuch as this cannot be accomplished, the reduction of maxillary protrusion in Class II, Division I cases is best effected by a distal movement of all the maxillary teeth; in cases where that is not possible, the six anterior teeth may be moved distally after the removal of two maxillary premolars. We must question the advisability of either moving all the maxillary teeth distally or the extraction of two sound upper teeth. We know that there is a lack of information regarding the forward growth of the jaws, particularly the forward growth of the alveolar processes and the teeth in relation to the malar bones. From past experience, we also know that the amount of distal movement we can hope for, even with the most efficient appliances, cannot be more than 1 or 2 mm. Therefore, the question arises as to whether the actual distal movement of the teeth during treatment has any real value. If the maxillary teeth move forward through the bone and keep on doing so for years after orthodontic treatment is completed, then we may ask what would keep them in the positions in which we place them? It may be explained that if normal occlusion is established the function of the mandible may keep everything in position, but it should be kept in mind that there is the strong possibility that the mandible will follow the maxillary teeth and do its own readjusting through its compensating mechanism. In other words, the distal movement of the maxillary teeth is only temporary and the upper teeth will keep on moving forward until full development is reached, regardless of what we may do in the way of treatment. It may be true that this could be a way of establishing normal occlusion which would be always followed by a forward positioning of the mandible, but it is equally true that in the past the classic treatment of bringing the entire lower jaw forward by means of intermaxillary elastics was also successful in many cases.

The ability of the mandible to compensate for differences of growth in the structures included between the glenoid fossa and the upper anterior teeth also should be studied very carefully. Everything known about the adaptability of the mandible points to the possibility of the permanent repositioning of the mandible. I, personally, believe that the mandible adjusts itself to

major changes in occlusion and I cannot reconcile myself to the idea that the position of the lower jaw is fixed permanently and cannot be changed by orthodontic means. Taking this point of view into consideration, together with the knowledge that the maxillary teeth move forward regardless of what we may do during treatment, the importance of the distal movement of the maxillary teeth diminishes, while the repositioning of the mandible becomes an important requirement in the successful treatment of Class II, Division I cases. This appears to be the most logical approach, but it must be backed by extensive research conducted along broad lines based on the study of growth.

During the development of a challenging specialty such as orthodontics, many unconfirmed hypotheses, concepts, and so-called theories are advanced. Some of these may gain universal acceptance, with or without merit. The right should be given us to voice our opinions freely in a constructive manner, and we must be given the opportunity to appraise accepted practices. The gracious acceptance of wholesome criticism is one of the most important requirements of men of science, for it matters little "who is right or who is wrong." The all important thing is to establish "what is right and what is wrong." With this attitude, we shall raise orthodontics as a profession to a very much higher level, and reduce the injuries which may be inflicted on our patients by our hastily accepting unconfirmed hypotheses and faulty theories.

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PREVENTIVE DENTISTRY AND PREVENTIVE ORTHODONTICS THROUGH PUBLIC DENTAL HEALTH EDUCATION

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I. THE PROBLEM

INTRODUCTION

DENTISTRY has made remarkable progress during the past century, and especially during the past twenty-five years, through education, research, legislation, materials, technical procedures, et cetera. Although preventive dentistry has not kept pace with the other advancements, it should be recognized as an essential health service.

There has been an apparent indifference on the part of the public as to the importance which should be placed on the prophylactic care of the primary dentition, early loss of primary teeth, neglect of proper space maintenance, replacement of lost permanent teeth, effects of prolonged thumb-sucking, pressure habits of the tongue and hand, prolonged retention of primary teeth, crossbites, and many other reasons for malocclusion.

The early recognition of these conditions by dentists and parents could minimize the orthodontic problems of dysfunction of occlusion, disharmony of the face, and some of the accompanying nutritional and psychological disturbances.

Gies[1] says:

> The solution of this important public problem is the dental profession's responsibility and also its opportunity. Expanding research, to increase the profession's power to prevent dental disorders, is a cumulative need. While the full fruitage of such efforts in research is awaited, it is evident that plans to provide adequate dental health care to all who need it when they need it should be devised and conducted by the dental profession. These plans should be evolved by the dental profession in fulfillment of its public obligations as a health-service profession, and in harmony with the profession's expert knowledge of dental health requirements.

In order that we may care more adequately for the dental health requirements, it becomes essential that we stress prevention. This requires a study into the causes of diseased conditions and an educational program to apply the findings—a program requiring education of the profession and of the public.

OCCURRENCE OF MALOCCLUSION IN A SCHOOL-AGE POPULATION

In a survey of the oral conditions of 103,570 school children in St. Louis,[2] the tabulations indicate that 51.9 per cent had some type of dental anomaly.

This thesis, which was given as a partial fulfillment of the requirements for certification by the American Board of Orthodontics, is being published with the consent and the recommendation of the Board, but it should be understood that it does not necessarily represent nor express the opinion of the Board.

Table I reveals that 17 per cent in the kindergarten showed deviation from normal, whereas 71 per cent in the twelfth grade (aged 17 to 18 years) had malocclusions.

Table II shows the distribution of the various conditions and Table III indicates the frequency of occurrence of the various types in an average population age group of 1,000.

TABLE I. PERCENTAGE OF MALOCCLUSION IN AGE GROUPS OF ST. LOUIS CHILDREN EXAMINED

PLACE IN SCHOOL	AVERAGE AGE (YEARS)	NUMBER EXAMINED	PER CENT HAVING MALOCCLUSION
Kindergarten	5-6	5,563	17.0
First grade	6-7	11,462	17.5
Second grade	7-8	10,231	31.2
Third grade	8-9	9,976	49.7
Fourth grade	9-10	9,878	53.9
Fifth grade	10-11	9,367	53.7
Sixth grade	11-12	8,968	54.0
Seventh grade	12-13	8,748	55.7
Eighth grade	13-14	7,633	55.6
Ungraded		573	61.0
Ninth grade	14.15	6,281	65.5
Tenth grade	15-16	5,211	66.8
Eleventh grade	16-17	3,585	70.8
Twelfth grade	17-18	2,810	71.2
Ungraded		186	54.8
Vocational	14-29	2,425	64.2
Teachers' college	16-29	573	41.8
Total		103,570	51.9

McCall,[3] in a study of malocclusion in preschool and school children reported that, of 775 children, 152 were in the age group of 2 to 6 years, of which fifty-eight, or 38 per cent, had malocclusion. Six hundred twenty-three were in the age group of 7 to 11 years, of which 371, or 60 per cent, had malocclusion. For the entire group studied, the per cent having malocclusion was 55.

TABLE II. DISTRIBUTION OF MALOCCLUSIONS AMONG AGE GROUPS

PLACE IN SCHOOL	NUMBER WITH MALOCCLUSION	PER CENT WITH NEUTROCLUSION	PER CENT WITH POSTEROCLUSION	PER CENT WITH ANTEROCLUSION	PER CENT WITH EXTREME DEFORMITIES
Kindergarten	966	72.4	17.7	9.2	0.5
First grade	3,580	81.2	12.2	5.9	0.4
Second grade	5,084	80.1	15.8	3.8	0.2
Third grade	5,404	78.4	17.8	3.3	0.3
Fourth grade	5,288	77.2	19.1	3.3	0.2
Fifth grade	4,984	74.7	21.8	3.1	0.3
Sixth grade	4,778	72.7	23.8	3.0	0.3
Seventh grade	4,798	72.0	24.4	3.1	0.4
Eighth grade	4,171	72.2	24.0	3.3	0.3
Ungraded	350	62.0	32.5	5.1	0.2
Ninth grade	4,017	82.8	13.9	2.5	0.4
Tenth grade	3,417	79.9	15.8	3.7	0.4
Eleventh grade	2,461	83.9	12.3	3.1	0.4
Twelfth grade	1,927	84.7	11.3	3.5	0.3
Ungraded	97	61.8	29.8	8.2	0.1
Vocational	1,537	80.2	15.9	3.7	0.2
Teachers' college	244	51.6	43.0	5.3	
Total	53,103	77.3	18.0	3.6	0.3

TABLE III. NUMBER WITH VARIOUS TYPES OF ANOMALIES PER 1,000 POPULATION

AGE GROUPS (YEARS)	NORMAL OCCLUSION	ABNORMAL OCCLUSION	SIMPLE NEUTRO-CLUSION	COMPLEX NEUTRO-CLUSION	POSTERO-CLUSION (LABIAL)	POSTERO-CLUSION (LINGUAL)	ANTERO-CLUSION	EXTREME DEFORMITY
5-6	830	170	48	76	29	1	15	1
6-7	825	175	54	88	20	2	10	1
7-8	688	312	79	171	45	4	12	1
8-9	503	497	109	281	83	6	17	1
9-10	461	539	120	297	96	7	18	1
10-11	463	537	101	301	105	11	17	2
11-12	460	540	85	308	117	13	15	2
12-13	443	557	83	316	124	13	18	3
13-14	444	536	92	310	119	14	19	2
14-15	345	655	160	382	76	18	16	3
15-16	332	668	137	398	71	31	25	6
16-17	282	706	140	455	61	27	22	3
17-18	288	712	127	476	55	26	25	3

AVAILABILITY OF DENTAL SERVICES

Brandhorst[4] reported that the required time to render needed dental services to various population groups (Table IV) would average approximately fifteen hours per person per year. Table IV is based on a survey of oral conditions of the school children in St. Louis, Missouri, in 1932 and on the report of the Socio-Economic Committee of the Missouri State Dental Association.

If all the people were served, the amount of time available to the dentists (Table V) would have been only one hour for each person per year.

TABLE IV. TIME REQUIRED FOR DENTAL SERVICES

POPULATION GROUPS	HOURS
Kindergarten child	5.23
Grade school child	6.35
Vocational pupil (white)	10.6
High school pupil	8.8
Teachers' college (white students)	7.7
Rural grade school child	7.8
White-collar person	15.7
Merchant	18.7
Professional person	12.1
College student	12.2
Farmer	21.4
Housemaid	20.8
Housewife	18.9
Trade and factory workers	23.5
Urban adult	17.2
Rural adult	19.2
Unclassified person	18.8

TABLE V. AVAILABLE DENTAL TIME

Average number of hours in dentist's working day	8
Average number of working days per week	5
Average number of working weeks per year	50
Average number of working hours per year	2,000
Approximate number of dentists in the United States	62,500
Approximate population of the United States	125,000,000
Average number of persons per dentist	2,000

In the light of more recent figures[5] as to the number of dentists and population, we find an increase in population, an increase in the number of dentists, and a decrease in the population per dentist. The estimated population in the United States in 1953 was 160,000,000 and the estimated number of dentists was 93,000. The dental problems have not been solved, and we still find the need for a better balance between time available and time needed. The solution to the dental health problem, therefore, lies in prevention. Preventive orthodontics is especially necessary because of the high percentage of people with malocclusion and the limited number of dentists who treat the orthodontic defects.

II. The Attack

FLUORIDATION OF COMMUNITY WATER SUPPLIES

The high percentage of caries-free teeth of children and adults in some localities of the United States has been the cause of recent extensive research in caries prevention. As a result of this research, it was discovered that the fluoride content in the public water supply had a direct bearing on the control of dental caries.

The dental and medical professions and the health departments recognize the benefits of adding a controlled amount of fluoride ions (one part fluoride to each one million parts of water) to the public water supplies where there is a low content of fluoride or where the water is fluoride-free.

Fluoridation is not a cure for dental caries, but dental scientists now can confidently predict that children who drink fluoridated water during the years in which teeth are formed will have from 60 to 65 per cent less dental caries than those of the corresponding age group who live in areas with fluoride-free water.

It can be expected that with less caries there will be a reduction in the number of primary teeth prematurely lost, a reduction in the loss of permanent teeth, and a reduction of malocclusion.

In a recent report by the Council on Dental Health of the American Dental Association,[6] the annual survey shows that more than fourteen million persons in the United States are routinely drinking fluoridated water.

Fluoridation of public water supplies was started in 1945, when the first six projects, serving 209,547 persons, were established in the United States. Acceptance of the public health procedure has continued to increase since that time. Additions in succeeding years were as follows: 1946, 7 (92,613); 1947, 4 (96,276); 1948, 7 (105,260); 1949, 20 (442,129); 1950, 40 (432,504); 1951, 225 (3,062,729); 1952, 347 (8,496,523); 1953, 108 (1,322,727); for a total of 764 communities and a total population of 14,224,662. No reports were received from three states, but tabulations on previous reports were used. The previous report was to June 1, 1953, and, as of July 31, 1953, fourteen more communities, with a population of 838,631 people, have started the fluoridation of their water supplies.

The states in which projects have not been adopted are Arizona, Missouri, Nevada, New Mexico, and Utah.

There is still some opposition in eighty-seven communities in twenty-two states, which has temporarily denied the benefits of fluoridation to more than four million persons.

In the *Report of the United Kingdom Mission on Fluoridation in North America,*[7] it is concluded that, among children in communities in which fluoride is added to the public water supply, there is a reduction in the incidence of dental caries to a level comparable with that experienced where fluoride occurs naturally in the water.

PUBLIC DENTAL HEALTH INFORMATION

In a recent report from the Chairman of the Council on Dental Health, Missouri State Dental Association, we find that the state dental health educational program is quite active.

The director of the Division of Health of Missouri reports that there are forty-two official dental health educational programs operating in Missouri. Of the communities where practicing dentists are located, 65 per cent have programs; 68 per cent of the population resides in these areas.

Some of the programs include routine dental examinations, movies, distribution of literature, and educational programs in the schools. For the period from July, 1952, to January, 1953, 520 movies were shown to 41,880 people. It was estimated that approximately 10 per cent of the 500,000 people attending the Missouri State Fair saw the dental educational exhibits.

The Council on Dental Health of the St. Louis Dental Society is active throughout the year. National Children's Dental Health Day receives considerable attention through the distribution of leaflets on dental health (160,000), emphasizing the use of health-building foods, careful brushing of the teeth, regular visits to the dentist, fluoridation, et cetera. Placards calling attention to this day are placed in streetcars, buses, and other public places. Many programs are provided the schools by the St. Louis Dental Society Speakers' Bureau. The newspapers, radio stations, and television stations carry articles and programs stressing the importance of this day and its significance in terms of improved dental health.

The Speakers' Bureau of the Council on Dental Health of the St. Louis Dental Society was organized to give educational talks on general dentistry, but for the last three years the speakers have been instructed to talk on children's dentistry and fluoridation, and the Bureau reports increasing activity in the past three years. In 1951 they had requests for and filled seven engagements; in 1952, seventeen engagements; and in 1953 (to November 1), thirty-one engagements. Most of these engagements were at schools, but several were at service clubs.

The Radio Committee of the St. Louis Dental Society, Council on Dental Health, has been an important link in the chain of public dental education. The Council has a fine library of scripts which are available to the committee. It is through the civic consciousness of the local radio stations that the dental

health messages can reach the listening public. The medium of radio is being used throughout the state for dental health messages, and one local dentist has presented a weekly program since 1944.

Television has been used to a much less degree than the radio, but in the near future St. Louis will have an educational television station which will be available to the local dental societies for programs on dental health education. Scripts are being prepared to be televised in schools for children at all age levels. The evening programs will be prepared at the adult level. This station will cover an area within a radius of more than 50 miles around St. Louis with a population of nearly 2,000,000 people.

DENTISTRY AND DENTAL HEALTH EDUCATION IN THE SCHOOLS

The Health and Hygiene Division of the Board of Education conducts a dental health program in the St. Louis public schools. School dentists cooperate closely with school physicians, so that the dental health and general health of the child may be closely correlated.

The dental examinations in the school are conducted for the purpose of referring children for corrective service, to serve as a medium for conveying dental health education to parents and children, to obtain data for use in evaluating the dental health of the school, and to furnish information needed to correlate the child's dental and general health.

Parents are invited to be present during the dental examinations held in the schools. Each morning a talk on the more vital points in dental health is given by the school dentist to parents as a group before the examinations start. The parent then sits beside the dentist as the examination proceeds and is shown the actual conditions found in the mouth of the child. The dental health of the child is discussed freely by the school dentist. More than 45,000 parents have attended the examinations since the program was inaugurated seven years ago.

When all the children in a school have been examined, the dentist shows a dental film, having first prepared the children for the content of the film. After the showing, the film is discussed. The point of completion of the examination affords a good opportunity to tell the children of the conditions found in their mouths, the value of oral hygiene, tooth-brushing technique, the sources of decay, and what the children themselves can do to reduce decay.

A dental film library is maintained by the Audio-Visual Education Department of the Board of Education. The present list of dental films includes *Behind the Smile, Open Wider Please, Student Flyer, Teeth Are to Keep, The Teeth, Our Teeth,* and *It's Your Health.* In addition, many dental film strips are listed.

Dental health education is also carried to children in the classroom through the channel of FM radio. The broadcasting station, KSLH, owned and operated by the Board of Education, was opened on April 13, 1949. Dental lessons, as well as those in other phases of the school curriculum, are written to invite classroom participation. Programs are graded to meet the age level for which they are intended. In the dental broadcasts of fifteen minutes, the programs are built around a single theme and are either dramatized or given in story form.

A pre- and postbroadcast manual is prepared for the teacher for each series of broadcasts. This manual enables the teacher to prepare the children for the broadcast, and later to discuss with them its content.

Some broadcast subjects include *Colonel Brush* (tooth-brushing), *I Know a Secret* (visit to the dentist), *A Trip to the Farm* (food and diet), *What Was Lost* (loss of a tooth), and *Surprise for Nancy* (dental care and advice given by the dentist).

The dental health picture in St. Louis public schools has shown steady improvement under the dental health program since the first examination of all schools was completed in 1946.

The first examination showed that 77 per cent of the elementary school children were in need of dental treatment. This figure has now been reduced to 73 per cent. Some schools have shown a marked reduction in the number needing treatment, dropping in one case from 93 per cent to 60 per cent. While the 73 per cent leaves much room for improvement, it is a far cry from the 95 per cent recorded in 1933.

The St. Louis Municipal Dental Clinics are located for easy access by indigent children up to and including the eighth grade. Three teams, each consisting of a dentist and an assistant, examine children, educate the parents and children in dental health, and refer them to the proper clinic. The child is given a prophylaxis at the first visit, necessary extractions are performed and the cavities are filled at subsequent visits. Root canal work is done and roentgenograms are taken when necessary.

When the work is completed, the charts are filed as a permanent record which is available when the child returns at six-month intervals.

The St. Louis County Dental Health program is similar to the Municipal Clinics program.

SOCIAL SERVICE DENTISTRY BY PRIVATE ORGANIZATION

Another source of prevention and dental care in the St. Louis area came about in 1948, when the Kiwanis Clubs decided to start a long-range program to aid indigent children. The suggestion was made by a dentist, Dr. Russell Smith, that a mobile dental trailer be purchased from the Government. The idea was backed by a few Kiwanians and funds have been raised by the local clubs to purchase and maintain the Kiwanis Dental Trailer. A dentist and an assistant were engaged and the program was started early in 1949. The trailer is stationed at a school, orphanage, or other institution until all eligible children have received the necessary dental care. In order for a child to be eligible, his parents must have an income of $160.00 or less per month for one child and $20.00 additional for each additional child. By December, 1949, eleven places had been visited and, by 1952, children in thirty-seven institutions had received dental care.

In the spring of 1953, plans were made for a new trailer. It was finished, equipped, and dedicated on July 29, 1953.

Since the beginning of the programs, 5,744 children have received 25,785 operations. The children are treated as they would be in a private office and are not required to leave the school or institution.

A COMMUNITY PROGRAM FOR PREVENTIVE DENTISTRY

A conference on dental health education, sponsored by the Missouri State Dental Association, Missouri State Department of Education, and the Missouri State Division of Health, was held on Nov. 19 and 20, 1953, at Jefferson City, Missouri.

The purpose of the conference was to consider the problem of dental health education in Missouri and to determine how dental health education can be carried on more effectively for the improvement of dental health. The objective was a working program in dental health education.

There were six basic approaches to the dental health problem:

1. Dental health education.
2. Caries control through fluoridation of public water supplies.
3. Caries control by means of topical fluoride treatments.
4. Reduction in the consumption of sweets.
5. Regular and correct oral hygiene procedures.
6. Oral prophylaxis and regular dental office examinations and treatment.

The participants at the conference were representatives from the Missouri State Dental Association, Missouri State Department of Public Health and Welfare, Division of Health, Division of Welfare, Missouri State Department of Education, University of Missouri, American Dental Association, United States Public Health Service, Public School Administrators, Missouri Farm Bureau Federation, Missouri Farmers' Association, and the Missouri Congress of Parents and Teachers.

Participants from various departments read papers presenting the problem of dental health education, the resources, and the potential of the State Department of Education in the dental health program.

Discussion groups were assigned to consider the following questions:

Group I

1. What is the total dental health education problem in Missouri?
2. Who should be responsible for dental health education, and how can they be influenced to accept their responsibility?

Group II

1. What is the extent of the school's responsibility for dental health education?
2. What are the problems of school dental health education?

Group III

1. What age groups are most effectively influenced by dental health education?

2. How can all interested groups work together for better dental health education?

A summary of the reports of the discussion groups follows:

Every citizen in Missouri should be informed, directly or indirectly, of the value of oral health and the dangers of oral diseases, motivating him toward prevention and control of pathologic or abnormal conditions.

The problem was based on four categories: (1) prenatal, (2) preschool, (3) child in school, and (4) adult.

The following recommendations were made:

1. A dental consultant should be included in planning for prenatal and postnatal care.
2. Preschool children should have early instruction in oral hygiene, which should come from the well-informed parents.
3. An adequate dental health educational program should be available for all children of school age.
4. The adult should have an opportunity for dental health education.

The responsibility for dental health education in these categories rests with the following individuals or groups:

1. Prenatal care
   (a) attending physician and dentist
   (b) local health departments
   (c) qualified clinical personnel
2. Preschool
   (a) parents or guardian
3. Child in school
   (a) teachers
   (b) parents or guardian
   (c) dentist and physician
   (d) local health department
4. Adults
   (a) individual

Facilities for dental health education should be made available to persons in every community.

Responsibility for the dental health educational program can be accepted only after it has been thoroughly explained to the parents, teachers, the health professions, and the community at large.

Recommendations were made that:

1. A dental health educational program be included in the teachers' curriculum.
2. School boards conform to the recommendations of the American Dental Association and the American Medical Association with respect to the sale of food and drink to pupils; the schools eliminate the sale of sweetened beverages and confections.

3. Opportunities for dental examinations and follow-through be available in schools.

4. The dental care of indigent children be provided by the community.

5. The child be taught to assume responsibility for his health.

6. Fluoridation of communal water supply be endorsed.

7. Distribution of dentists be developed to care adequately for the entire population of the state.

8. Appropriate school personnel work with parents of preschool children on the dental health educational program.

9. Material approved by the American Dental Association be available for teaching purposes.

10. Material be concise, appealing, and interesting to the teacher and pupil at the different teaching levels.

Dental health programs are most effective in the kindergarten and elementary grades, because of the impressionable age of the pupils. The appeal for better oral health for the high school pupil should be from the psychological approach of improving his appearance. Experience has shown that adult groups are more difficult to reach in health educational programs.

Preventive dentistry and preventive orthodontics, or any specialty of the healing art, can be attained to the highest degree of development only after the practitioners are able to educate the members of society in such manner as to make it possible for them to understand the importance of prevention.

Each profession and each specialty is conducting research at a tremendous cost in time and money. Research in the field of medicine has provided sera of various types for immunization to combat diseases and, through education, society at all levels has accepted them in order to prevent diseases. It is true that we in the dental profession do not have a serum to combat dental caries and other oral disorders, but in recent years of research and education of the dentists and laity preventive dentistry is gaining a foothold. Unquestionably, we are in a better position today than ever before to teach and practice preventive dentistry, which includes preventive orthodontics.

Eventually, a reasonable success will be attained by those who intelligently instruct parents and children in this important phase of personal health. Certainly, preventive dentistry offers the only means whereby the great mass of humanity can be aided by our profession.

III. Conclusion

Dental disease is universal and, although only approximately 30 per cent of the population regularly receive dental service, the value of dental health should be taught to the entire population.

The primary dental health problem is the lack of awareness of its importance.

The potential of a dental health program is difficult to imagine. The full impact of dental disease upon the individual is difficult to estimate. Adverse psychological reactions resulting from obvious dental defects are undoubtedly the basis of a variety of social maladjustments that may continue throughout life. Limited masticatory function, pain, and oral sepsis contribute to impairment of general health and physical and mental efficiency. Ira Dow Beebe, speaking to the Fourth Annual Conference on Dental Health, estimated that absenteeism, due to dental disease, amounts to 45,000 employees per day.

If all the people with dental defects were to seek dental care, there would not be a sufficient number of dentists to care for their dental needs.

There is no easy solution to the problem of making dental care available to all persons who need dental treatment. Neither is there an easy solution to the problem of providing adequate dental health educational services to all members of the public. These problems are difficult to solve because they involve almost the entire population. It is illogical to assume that adequate treatment and educational services can be supplied for every person. It is much more realistic to attempt to reduce the size of the problem to a point where community facilities and resources can be applied effectively.

A great deal of progress has been made for dental health education and expanding oral health services. Facilities for providing dental care have increased over the years; people are more interested in dental health than they were in past generations; the dental profession and allied health professions are doing a better job of teaching dental health facts and of improving habit patterns and attitudes.

The job that lies ahead is to continue these improvements and to accelerate the achievements of dental health goals in the future.

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In Memoriam

ALFRED J. OLIVER

1898-1954

ALFRED J. OLIVER was born on Oct. 23, 1898. Dr. Oliver received his early education at Milford High School and graduated from Tufts Dental College in 1919. He devoted his efforts energetically to general practice for fourteen years, during which period it became more and more evident to the young doctor that his heart belonged to orthodontics. By 1933 he had made the decision to specialize and the following fall he enrolled at Harvard Dental Graduate School, graduating in 1935. From that time until his death in March, 1954, he enjoyed an active practice in orthodontics in his home state of Massachusetts.

Alfred J. Oliver was an outstanding man, not only in his chosen profession but in his community as well. His interests were many and he supported enthusiastically the activities of both local and state orthodontic and dental societies. He attended the Harvard Orthodontic Clinic and held a membership in the Guild of St. Appolonia.

He was modest and conscientious, spending much of his time in studying and reading everything that would tend to improve his technique and the treatment of his patients for whom he sacrificed so much of his health. They all cherish his memory and, with his widow, will miss him greatly.

Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Orthodontische Apparatuure Platenatlas voor Tandartsen en Orthodontisten. (Orthodontic Appliances. Atlas for Dentists and Orthodontists): By J. A. C. Duyzings. Amsterdam: Dental Depot A.M. Disselkoen, 1954. 207 pages, illustrated.

This atlas, as is customary in works of this type, depends mainly on the illustrations and has a minimum of text material. The illustrations are, for the most part, outline drawings and are extremely easy to understand. In addition, the captions explaining the use of various appliances shown are printed in English, Dutch, French, and German. Although such standard American appliances as the Angle edgewise, the Johnson twin-arch, and the Crozat are touched upon, the greater part of the atlas is devoted to the presentation of appliances used in Europe.

It is the aim of the atlas to present appliances which may be employed to effect tooth movement, but it does not undertake to prescribe treatment in any given case. The basic principles of orthodontics, including treatment planning, are left to the orthodontic textbooks which now exist. Thus, this atlas is for use by those who already possess orthodontic training and is not to be taken as a textbook for those who seek to enter the practice of orthodontics.

Dr. Charles F. L. Nord, a leading proponent of preventive orthodontics, in his "Introductory Note" to the atlas, states that the atlas will enable the general practitioner "to form an idea of the potentialities in this field and, more specifically, of the simple ones." It should be remembered also that the decision as to whether a given case of malocclusion is a simple one requires far from simple orthodontic experience.

Illustrations are presented of various clasps and springs and the method of their insertion into acrylic plates. Among the expansion plates shown are those with coffin springs and various screws. The use of plates with springs for moving premolars and canines distally are shown. These should prove helpful to those who resort to extraction in treating malocclusion. The expansion plate, with vertical extension to the mandibular arch for treating cross-bite of the posterior teeth, is shown. Plates with attached springs are presented for bite opening, for moving individual teeth, and for opening spaces.

The oral screen, which has gained much favor in the United States during recent years, is presented here as a preventive appliance in lip biting and tongue thrusting and as an orthodontic appliance for treating extreme overjet, overbite, and open-bite.

Various applications are presented of the Robin Monobloc and its modifications for use in orthodontic tooth movement. The Andresen activator and a number of modifications are shown, but their method of construction for use in different types of malocclusion is omitted.

Duyzings presents an expansion plate with two buccal wires for use in preventing buccal tipping of the teeth during arch expansion. The use of coil springs is shown in connection with removable plates for opening and closing spaces and for moving teeth in extraction cases. In his presentation of the removable lingual arch appliances, the author fails to give credit to John V. Mershon who originated this appliance and brought it to a high state of perfection.

While many of the appliances shown will prove bewildering to the American orthodontist, who will also wonder how the general practitioner with limited orthodontic knowledge can use them effectively, he will find the atlas rewarding, nevertheless. Many of the appliances shown will lend themselves for adoption by the orthodontic specialist in America. This book deserves the attention of orthodontists who are open-minded and who are willing to employ and test useful appliances, even if they differ from the "system" which they are wont to follow. The author is to be congratulated on his excellent presentation of the subject.

News and Notes

Middle Atlantic Society of Orthodontists

The Middle Atlantic Society of Orthodontists will hold its next annual meeting Oct. 5, 6, and 7, 1955, at the Shoreham Hotel in Washington, D. C.

Southern Society of Orthodontists

The Southern Society of Orthodontists will meet in Charlotte, North Carolina, Sept. 25 to 28, 1955.

Southwestern Society of Orthodontists

The next meeting of the Southwestern Society of Orthodontists will be held in Wichita, Kansas, at the Broadview Hotel, Oct. 16 through 19, 1955.

Temple University

The Dental School of Temple University, Philadelphia, Pennsylvania, announces a postgraduate course in orthodontics under the direction of Robert H. W. Strang, D.D.S., to start Jan. 22, 1956.

Faculty of Odontology of Pernambuco

The City of Recife, Brazil, has established the Faculty of Odontology of Pernambuco for the development of medical-odontological education in that state.

The supporting society is under the direction of Prof. Nelson Melo and Drs. Orlando Parahim and Clovis Lacerda Leite, president, vice-president, and secretary, respectively.

American Dental Association

At a meeting of the American Dental Association Council on Dental Education late in May, 1955, a resolution was adopted with regard to limiting the number of dental specialties.

"The council voted to hold a workshop on dental specialties in 1956 with representatives of the American Association of Dental Schools, the American Association of Dental Examiners, and specialty boards and groups in order to 'consider a workable plan of defining and recognizing the dental specialty areas.' The moratorium on acceptance of new specialty applications will continue 'until a solution is reached . . . to prevent over-segmenting dental practice,' the council resolution said."

Federal Trade Commission

A code of fair practices for the dental laboratory industry has been announced by the Federal Trade Commission. As required by law, the "public hearing" on the code was conducted in the third floor Hearing Room of the FTC in Washington, D. C., on Friday morning, June 24. First presented to the industry at the annual meeting of the National Association of Dental Laboratories in New Orleans in September, 1954, the code met with enthusiastic approval by the laboratory men as well as the dentists and men from the dental trade who were present. At that time, suggested changes were made in the code and these changes have been incorporated by the Commission in the revised code to be presented at the public hearing.

Official announcements of this hearing from the Commission were sent out, inviting, in behalf of the United States Government, all dental laboratory operators and members of the dental trade and dental profession to attend the hearing and to present arguments for and against the code. In charge of the hearing was Commissioner Lowell B. Mason, assisted by Colonel David Stauffer, attorney for FTC.

The code, as revised, will cover deceptive advertising, demonstrations, and claims; deceptive use of trade or corporate names or trademarks; substitution of products; false invoicing; defamation of competitors; enticing away of employees from competitors; use of the word *free;* coercion in the purchasing of products; fictitious prices; guarantees and warranties; advertising to the public; prohibitions in the Robinson-Patman Act; and selling below cost.

T. M. Graber to Lecture in Europe

Dr. T. M. Graber, associate professor of orthodontics of Northwestern University, will give a series of lectures in Europe this summer.

He will lecture in London, Paris, Copenhagen, and Stockholm. In August he will address the forty-third annual meeting of the Federation Dentaire Internationale in Copenhagen.

Notes of Interest

Warren G. Kennard, D.D.S., M.S.D., announces the opening of his office, for the limited practice of orthodontics, in the Wolcott Building, Hutchinson, Kansas.

Joseph Zeger, D.D.S., announces the removal of his office to 42 Front St., Binghamton, New York, practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES

THE AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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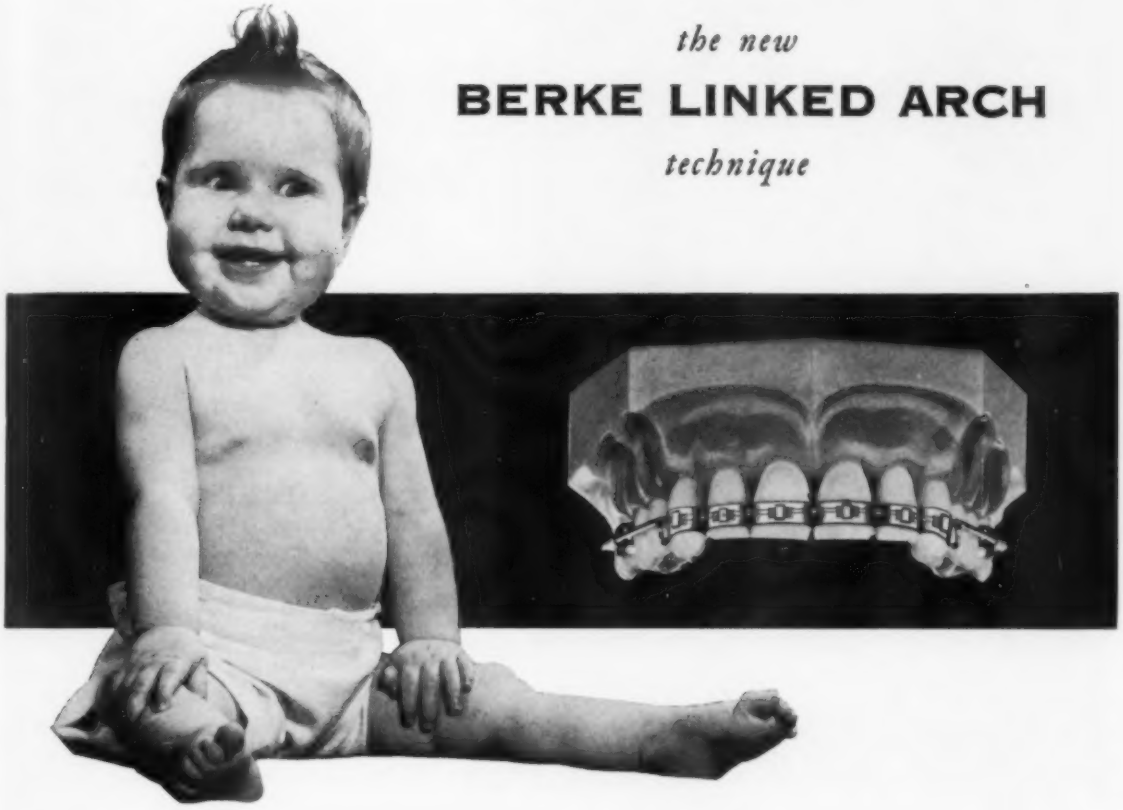

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